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NL I 002 0429

FINAL REPORT

TCLP SCREENING

NATIONAL LEAD INDUSTRIES SITE
PEDRICKTOWN, NJ

FEBRUARY, 1993

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1.0 INTRODUCTION

1.1 Objective of this Study

The objective of this project was to evaluate representative contaminanted soils and sediment at the National Lead (NL) site, with respect to compliance with Resource Conservation and Recovery Act (RCRA) criteria for classification as a hazardous material through TCLP procedures.

1.2 Site Background

The NL Industries site is located in Pedricktown, Salem County, New Jersey (Figure 1). The site is an abandoned secondary lead smelting facility located approximately 1.5 miles east of the Delaware River. The facility is situated on 44 acres and was operated from 1972 to 1984. Lead batteries and other lead materials were handled by this facility. Site contaminants include lead (Pb), cadmium (Cd), and chromium (Cr).

The area of investigation roughly included the area between two streams running in a northerly direction along both sides of the former facility, and areas mapped as forested wetland which are associated with these drainages[1]. Concentrations of Pb in surface soil range from 35 milligrams per kilogram (mg/kg) to above 20,200 mg/kg[1].

2.0 METHODOLOGY

2.1 Field Sampling Design

Twenty-seven sample locations in the area immediately surrounding the NL Industries site were screened for Pb using X-Ray Fluorescence Spectrometry (XRF) (Figure 2). Based upon these results, 18 of these locations were actually sampled. These consisted of 14 soil samples and four sediment samples. The samples were collected across a range of concentrations in the West Stream and within four general habitats, each with different soil types. Four samples were collected from the West Stream (sediment/muck), four from the upland forest (sandy loam), five from the forested wetland (sandy loam with high organic content), and five from the facility area (loamy sand).

2.2 XRF Screening

Upland and facility soil samples were screened using XRF in situ. Previously sampled areas were included in order to minimize time and effort spent in locating desired

soil concentrations. If, upon screening, a sample was within the desired concentration range, it was collected with a decontaminated stainless steel trowel and homogenized before placement into glass jars.

Wetland and stream samples were collected using a decontaminated stainless steel bucket auger or trowel, homogenized in an aluminum pan, and apportioned into labeled glass jars. A 2-ounce aliquot from each jar was dried and screened using XRF. Samples which were selected were retained in glass jars on ice. Otherwise a sample was returned to its original location.

2.3 Soil and Sediment Sampling

At each location selected for analysis, three jars were filled with the homogenized soil. These included one 32-ounce jar for grain size analysis and one 16-ounce jar for Atomic Absorption (AA) analysis of metals and Toxicity Characteristic Leachate Procedure (TCLP) Metals. A 2-ounce jar for Total Organic Carbon (TOC) analysis was also collected. At locations with wet soils, an additional 2-ounce jar was filled for XRF screening according to the procedure above (section 2.2).

Field sampling activities were conducted according to the following U.S. EPA ERT/REAC Standard Operating Procedures (SOPs): SOP #1713, Spectrace 9000 Field Portable X-Ray Fluorescence Operating Procedures; SOP #2012, Soil Sampling; SOP #2016, Sediment Sampling; SOP #2125, Trowels and Scoops, and SOP #2127, Hand Bucket Augers.

All sampling equipment was decontaminated between locations. Decontamination procedures followed the sequence below:

- Soil and other material were physically removed.
- Equipment was washed with soap and potable water.
- Equipment was rinsed with distilled water.
- Equipment was sprayed with 10 percent nitric acid.
- Equipment was rinsed again with distilled water.
- Equipment was allowed to air dry.

Sample handling and documentation followed U.S. EPA ERT/REAC SOPs #2002, Sample Documentation; SOP #4004, Chain of Custody, and SOP #2003, Sample Storage, Preservation and Handling.

2.4 Analyses

All analyses were conducted by a subcontracting laboratory (ATEC Consultants, Inc., Indianapolis, IN). Eight metals on the TCLP list, including Cd, Cr, Pb, arsenic (As), barium (Ba), mercury (Hg), selenium (Se), and silver (Ag), were analyzed using AA (procedures in Appendix A). After an aliquot was taken for AA analysis, the remainder of the sample was submitted for TCLP analyses. Grain size and TOC analyses were also conducted.

2.5 Data Analyses and Interpretation

In order to determine if metals were collocated, the concentrations of metals which were found above their respective detection limits were analyzed using correlation analysis.

All metals found above their respective method detection limits were analyzed to determine the percentage of metal leached during the TCLP analysis using the following procedure.

- Analytical results were converted to a dry weight basis, so that comparisons were not influenced by the moisture content of the sample. Since moisture content could be expected to change drastically with field conditions, e.g., a wetland may not always be wet, conversion to dry weight allows a common basis for comparison of soil/sediment leaching ability between sample locations.

- The amount of metal (in mg) present in the 100-g sample used for the TCLP extraction procedure was determined by multiplying the dry weight concentration (mg/kg) by 0.1 kg, since there are 1000 g in a kg.

- The amount of metal (in mg) extracted from the 100-g sample was calculated by taking the measured concentration in mg/L and multiplying it by 2 L, the amount of solution used to extract the metal.

- This quantity was divided by the original amount of metal present in the soil (mg) to determine the percent of the original metal lost to leaching during the procedure.

3.0 RESULTS

3.1 XRF Screening

Results of XRF screening for Pb revealed surface concentrations ranging from 230 mg/kg to 19,180 mg/kg (Table 1 and Appendix B). Concentrations in the upland forest located off site and east of the facility (Points E12-E29) ranged from 370 to 1230 mg/kg. A high concentration of 3220 mg/kg was recorded at sample point EE1A, located within the "hotspot" in the forested wetland southeast of the facility (Figure 2).

Sample points screened within the immediate vicinity of the facility (P1-P5) ranged in concentration from 230 to 10,000 mg/kg Pb. Points selected in the forested wetland located west of the facility (points W2-W20) had concentrations ranging from 730 to 19,180 mg/kg (Table 1 and Figure 2). Sediment samples collected from the West Stream (S2-S13) ranged in concentration from 270 to 17,930 mg/kg.

XRF concentrations determined in the field (in situ in the case of soils) were notably higher than those measured by AA in the samples actually collected (Table 2). However, a regression of AA versus XRF results indicated the two data sets were positively correlated, and a regression analysis indicated a significant linear relationship between AA and XRF results ($p<0.01$). Nevertheless, there was significant variability evident ($r^2 = 0.38$, Appendix C).

3.2 Metals in Soil and Sediment Measured by AA

3.2.1 Lead

At all locations, Pb had the highest concentration of any metal analyzed by AA, with concentrations ranging from 96 to 16,000 mg/kg (wet weight). Wet weight Pb concentrations were correlated with those of As, Ba and Cd ($r=0.63$, $r=0.66$, and $r=0.75$, respectively), indicating these metals are collocated to some degree.

3.2.2 Other Metals

Of the remaining metals on the TCLP list, only Ba and Cr were found in all samples. Arsenic was found in all but one sample, while Cd was detected in approximately half the samples. Mercury, Se, and Ag were undetected at their respective detection limits in all samples (Appendix A, Table 1.1).

Barium was found in concentrations ranging from 6.8 to 87 mg/kg wet weight (Appendix A). The wet weight Ba concentration of 87 mg/kg at location W18 was substantially higher than that of the other sample locations. In addition to being correlated with Pb, wet weight Ba concentrations were significantly correlated with those of As ($r=0.77$, Appendix C).

Chromium was detected at values ranging from 4.8 to 38 mg/kg (wet weight). At 38 mg/kg wet weight, the concentration of Cr was substantially higher at location EE1A, the hotspot in the forested wetland southeast of the site, than at other locations. Concentrations of Cr were not correlated with any other metal.

Cadmium concentrations ranged from undetected to a maximum of 23 mg/kg wet weight. The latter value was recorded at location W18. Cadmium was significantly correlated only with Pb.

3.3 TCLP Metals Extracts from Soil and Sediment

3.3.1 TCLP Results for Pb

Lead was the only metal tested for which TCLP concentrations exceeded regulatory criteria under RCRA[3]. For Pb, samples from which the TCLP extract concentrations at or above 5 mg/L are considered hazardous materials under RCRA. This criteria value was exceeded in TCLP extracts from sample locations P3, P5, W18, W20, S13, and S11 (Table 3).

Results of TCLP analysis of Pb-contaminated soil and sediment showed the degree of leaching to vary with the original Pb concentration. The amount of Pb present in the TCLP extract was correlated with wet weight Pb concentrations in soil and sediment ($r=0.84$), and this relationship was highly significant ($p<0.001$, Appendix C). Conversion to dry weight concentrations lowered the correlation coefficient to 0.69, but the relationship was still significant ($p<0.001$).

Review of the data in Table 3, with the exception of location P2, indicates that the soil or sediment samples with less than 1000 mg/kg Pb had TCLP values of less than 1 mg/L Pb. A regression analysis using soil/sediment Pb concentration (dry weight) as the independent variable and Pb concentration in TCLP extract as the dependent variable showed the relationship to be exponential ($r^2 =0.84$, $p<0.01$).

The percentage of Pb from the original sample which leached during the TCLP analyses ranged from <1 percent to approximately 54 percent. Samples from locations P2 and P5 had a significantly higher percentage of Pb leached, with approximately 54 and 53 percent, respectively. Yet, while location P5 had the second highest Pb concentration of any soil sample (17,391 mg/kg, dry weight), the soil collected from location P2 had a Pb concentration measured at only 107 mg/kg dry weight.

The amount of Pb leached from the soil varied between areas of the site investigated (Tables 1 and 3). Samples collected from the woodland on the eastern side of the facility (E12-E29) and from the "hotspot" in the woods southeast of the facility (EE1A) ranged in Pb contamination from 325 to 927 mg/kg (dry weight). However, the percent of Pb leached in the TCLP analyses was under 3 percent in all six samples.

Samples collected in the immediate vicinity of the facility (P1-P5) ranged in Pb contamination from 107 to 17391 mg/kg dry weight and exhibited TCLP values ranging from approximately 5 to 54 percent. Samples collected from the forested wetland on the western side of the facility had a similar Pb contamination range (185 mg/kg to 18987 mg/kg dry weight), but the percentage leached ranged only from <1 to 12.64 percent. Finally, results of TCLP analyses of samples collected from the West Stream (S2-S13) indicate that while Pb contamination ranged from 368 to 13611 mg/kg dry weight, the percentage of Pb leached during the TCLP analyses ranged from only 1.57 to 6.32 percent.

3.3.2 TCLP Results for As, Ba, Cr, and Cd.

Arsenic was detected in the leachate of only two samples: S11 and S13 (Table 4). The percent of the original amount present which leached varied from ND to 12.96 percent. The maximum concentration of As leached was 0.9 mg/L.

Barium was detected in the leachate of all but four samples (E16-E29, and EE1A); these all had soil concentrations of less than 12 mg/kg (Table 4). The highest amount of Ba leached (1 mg/L) was from sample W2. The percentage of Ba leached from samples ranged from undetected to nearly 34 percent (sample location W2). The percentage of Ba leached from the sample was highly variable and did not appear to be related to the concentration in the soil or sediment. For instance, the highest

proportion leached (33.75 percent) was from sample location W2, where the soil concentration was 32 mg/kg. At locations W18 and W20 the soil concentrations were notably higher (87 and 47 mg/kg, respectively), yet the amount leached was substantially lower (5.99 and 5.17 percent, respectively).

Chromium was recorded in the leachate from only one sample (W18), at a concentration of 0.1 mg/L (Table 5). This represented 5.83 of the Cr in the soil sample. Cr was not detected in the leachate from two other locations (W20 and EE1A) where soil concentrations were notably higher.

Cadmium was found in the leachate of six of the 18 samples submitted for analysis. The maximum Cd level recorded was 0.4 mg/L, in sample number W18 (Table 5). The percentage of Cd released into solution did not appear to be directly related to soil or sediment concentrations; three samples with varying concentrations (P4, P5, and W18) had a similar percentage of Cd leached (from 25-27 percent, Appendix C). Maximum TCLP concentrations for all metals and corresponding maximum permissable levels under RCRA are presented in Table 6.

3.4 TOC of Soil and Sediment

TOC levels were below 30,000 mg/kg, the upper limit of the analysis, at locations P1 through P5 (Table 7). At these locations, TOC concentrations varied from 2,650 to 7,675 mg/kg. Exact concentrations at levels above 30,000 mg/kg could not be calculated by the subcontracted laboratory due to the high amount of organic material present in the soil and sediment at those locations. However, analyses conducted in a prior field investigation by U.S. EPA/ERT and REAC[2] using an alternative analytical method found levels ranging from 66,000 to 160,000 mg/kg in West Stream samples. In the same study, TOC values ranged from 13,000 to 68,000 mg/kg in soils collected in the woodland area east of the facility, and from 41,000 to 200,000 mg/kg in soils from the forested wetland west of the facility.

3.5 Grain Size of Soil and Sediment

Analysis of particle size distribution showed that the 18 soil and sediment samples collected consisted mostly of sand. Sand content ranged from 42.4 to 87.2 percent, with the majority of samples consisting of more than 50 percent sand (Table 8). Most of the sand fraction consisted of medium and fine sand. The proportion of

sand in samples from the eastern woodland (locations E12-E29) was consistently between 80 and 86 percent. Soil samples from the forested wetland west of the site had lower amounts of sand, which ranged between 40 and 80 percent. Samples collected within the immediate vicinity of the facility (P1-P4) had variable amounts of sand, ranging from about 60 to 87 percent. The sample collected from the woodland area southeast of the facility consisted of approximately 53 percent sand. Sediment samples collected from the West Stream (S2-S13) ranged from approximately 70 to 85 percent sand.

The silt fraction was highest (41.3 percent) in the soil sample collected from the southeastern woodland (EE1A). Both silt and clay percentages were highly variable in samples collected throughout the site; silt values ranged from approximately 10 to 41 percent, and clay values ranged from approximately 1 to 23 percent. Differences in silt/clay fractions between areas generally reflected the differences in sand content described above.

4.0 DISCUSSION

4.1 TCLP Results of Lead-Contaminated Soil and Sediment

Lead concentrations in leachate from the soil and sediment exceeded RCRA regulatory criteria at six sample locations: P3, P5, W18, W20, S11, and S13. These locations were scattered throughout the site; S11 and S13 were taken from the West Stream, W18 came from the forested wetland west of the facility, and P3 and P5 were from the facility area itself. These samples had the four highest Pb concentrations of the 18 samples analyzed.

The above results are consistent with a general trend in this investigation; as the initial Pb concentration of soil and sediment samples increased, a logarithmic increase was observed in the amount of Pb leached into solution. This was true despite some obvious differences in the grain size and TOC characteristics of the soils which were measured.

Although there is a definite trend toward increased leaching with contaminant concentration (see Section 3.3.1 above), comparison of individual samples with similar concentrations showed that they each leached a different proportion of the original Pb present. For example, soil from W18 had a concentration of 18,987 mg/kg Pb and leached 12.64 percent of the total Pb present, while soil from P5 had a concentration of 17,391 mg/kg Pb and leached 52.9 percent of its Pb. Sample locations within the immediate vicinity of the facility, P2, P3, and P5, exhibited the highest percentage of Pb

leached, however, only the second two locations exceeded RCRA criteria.

The proportion of Pb leached does not appear to be related to the grain size distribution of the soil. Similarly, TOC showed no apparent relationship with the percentage of Pb leached, although comparisons were limited by the censored nature of the data.

4.2 TCLP Results for Other Metals in Soil and Sediment

Arsenic was present in the leachate of only two sediment samples (S11 and S13), both of which were collected from the West Stream. Only about 13 percent of the original was leached from these samples, with less than 1 mg/L was detected in solution. A maximum concentration of 139 mg/kg As (wet weight) was found in the sediment.

Barium was detected in the leachate of all but four samples (E16, E17, E29, and EE1A). However, the maximum Ba concentration detected in leachate (1 mg/L) was well below the RCRA standard of 100 mg/L.

Chromium was found in the leachate from only one sample, location W18, but was well below the RCRA limit. No Cr was detected in the leachate of the sample with the highest initial Cr concentration (93 mg/kg), which was from location EE1A.

Cadmium was present in less than half of the soil and sediment samples, and it was detected in the leachate of only six samples. With a maximum leachate concentration of 0.5 mg/L, it is well within RCRA regulatory limits.

The remaining metals, silver (Ag), mercury (Hg), and selenium (Se), were undetected in the soil, sediment, and leachate.

5.0 CONCLUSIONS

(1) Lead concentrations in leachate, as measured by the TCLP procedure, exceeded RCRA regulatory criteria in sediment and soil from six of 18 sample locations (P3, P5, W18, W20, S11, and S13). These were located near the facility, in the forested wetland west of the facility, and in the West Stream (Figure 2).

(2) Lead concentrations in leachate increased logarithmically with the original sample concentration in the soil and sediment.

(3) Lead concentrations in leachate showed little relationship with grain size distribution or TOC content of soil and sediment samples.

(4) Remaining metals investigated (Ag, As, Ba, Cd, Cr, Hg, Se) did not exceed RCRA criteria in leachate from any sample location.

REFERENCES

(1) O'Brien and Gere. 1990. Remedial Investigation for National Smelting of New Jersey, Inc./NL Industries, Inc. Site. Volumes I-V. Unpubl. Manuscript.

(2) U.S. EPA ERT/REAC, 1992. Ecological Assessment of the National Lead Industries Site, Pedricktown, N.J. (Draft Document, Do Not Cite or Quote).

(3) Federal Register, Vol. 55, no. 61. Rules and Regulations. 1990.

Tables

TABLE 1. Soil and Sediment Sampling Locations for TCLP Analysis
NL Industries Site
December, 1992

Habitat/Location	Sample Location	XRF Measured Pb Concentration (mg/kg)[1]	Soil Type[2]
Forested Upland (East)	E12	370	Sandy loam; little organic.
	E29	30	
	E16	710	
	E17	1230	
Forested Wetland (Southeast)	EE1A	3220	Loam with high organic.
Facility Area	P2	230	Fine Sand.
	P1	410	
	P4	3780	
	P3	7040	
	P5	10000	
Forested Wetland (West)	W2	730	Highly organic.
	W12	1400	
	W18	10480	
	W20	19180	
West Stream Sediment	S2	270	Muck.
	S4	910	
	S11	5670	
	S13	17930	

[1]All values rounded to the nearest 10^1 place.
[2]General field observations.

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TABLE 2. Lead Concentrations in Soil and Sediment as Measured by XRF and AA
NL Industries Site
December, 1992

Sample Location	XRF Results (mg/kg)	AA Results (mg/kg wet weight)
E12	370	380
E29	530	270
E16	710	440
E17	1225	420
EE1A	3220	380
P1	410	170
P2	230	96
P3	7040	3600
P4	3780	1000
P5	10000	16000
W2	730	100
W12	1400	780
W18	10480	15000
W20	19180	5100
S2	270	140
S4	910	730
S11	5670	2200
S13	17930	4900

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TABLE 3. Lead Concentrations in Soil and Sediment, and Corresponding TCLP Extractions
NL Industries Site
December, 1992

Sample Location	Soil/Sediment Lead Concentration (mg/kg dry weight)	Pb Concentration in TCLP Extract (mg/L)	Percent Pb Extracted
E12	487	0.72	2.96
E29	325	0.42	2.58
E16	543	0.57	2.10
E17	494	0.55	2.23
EE1A	927	0.45	0.97
P2	107	2.90	54.38
P1	191	0.48	5.03
P4	1111	3.30	5.94
P3	3956	43	21.74
P5	17391	460	52.90
W2	185	0.24	2.60
W12	2294	0.90	0.78
W18	18987	120	12.64
W20	11333	18	3.18
S2	368	0.96	5.21
S4	1780	1.4	1.57
S11	5789	11	3.80
S13	13611	43	6.32

Boldface locations represent those which had leachate values in exceeding RCRA criteria.
MDL for the TCLP analysis was 0.05 mg/L.

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TABLE 4. Arsenic and Barium Concentrations in Soil and Sediment as Measured by AA, and Corresponding Concentrations in TCLP Extracts
NL Industries, Inc. Site
December, 1992

Sample Location	Arsenic Concentr-ation (mg/kg dry wt)	Arsenic TCLP Extract (mg/L)	Percent Arsenic Extracted	Barium Concentr-ation (mg/kg dry wt)	Barium TCLP Extract (mg/L)	Percent Barium Extracted
E12	6.0	ND[2]	*	23.0	0.12	10.4
E29	6.0	ND	*	11.0	ND[3]	*
E16	8.0	ND	*	11.0	ND	*
E17	6.0	ND	*	8.0	ND	*
EE1A	13.0	ND	*	34.0	ND	*
P2	3.0	ND	*	14.0	0.23	31.85
P1	6.0	ND	*	26.0	0.14	10.83
P4	11.0	ND	*	13.0	0.1	14.25
P3	21.0	ND	*	30.0	0.07	4.65
P5	15.0	ND	*	33.0	0.1	6.13
W2	13.0	ND	*	59.0	1.0	33.8
W12	56.0	ND	*	76.0	0.11	2.88
W18	66.0	ND	*	110.0	0.33	5.99
W20	124.0	ND	*	104.0	0.3	5.17
S2	ND[1]	ND	*	26.0	0.1	4.18
S4	10.0	ND	*	59.0	0.21	7.17
S11	79.0	0.5	12.67	39.0	0.16	8.11
S13	139.0	0.9	12.96	86.0	0.7	15.79

[1]Arsenic method detection limit = 2.0 mg/kg
[2]Arsenic TCLP method detection limit = 0.50 mg/L
[3]Barium TCLP method detection limit = 0.50 mg/L
*Indicates percentage was not calculated due since compound was undetected in leachate.

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TABLE 5. Cadmium and Chromium Concentrations as Measured by AA, and Corresponding Concentrations in TCLP Extracts
NL Industries Site
December, 1992

Sample Location	Cadmium Concentration (mg/kg dry wt)	Cadmium TCLP Extract (mg/L)	Chromium Concentration (mg/kg dry wt)	Chromium TCLP Extract (mg/L)
E12	ND[1]	ND[2]	11.0	ND[3]
E29	ND	ND	9.0	ND
E16	ND	ND	11.0	ND
E17	ND	ND	9.0	ND
EE1A	ND	ND	93.0	ND
P2	ND	ND	18.0	ND
P1	ND	ND	11.0	ND
P4	4.0	0.5	7.0	ND
P3	2.0	ND	11.0	ND
P5	22.0	0.3	15.0	ND
W2	ND	ND	9.0	ND
W12	ND	ND	21.0	ND
W18	29.0	0.4	33.0	0.10
W20	10.0	0.03	44.0	ND
S2	ND	ND	13.0	ND
S4	5.1	ND	19.0	ND
S11	26.0	0.07	13.0	ND
S13	19.0	0.07	19.0	ND

[1]Cadmium method detection limit = 2 mg/kg
[2]Cadmium TCLP method detection limit = 0.01 mg/L
[3]Chromium TCLP method detection limit = 0.05 mg/L

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TABLE 6. Maximum TCLP Concentrations of Metals as Compared to RCRA Regulatory Limits
NL Industries Site
February, 1993

Element	Maximum Concentration Measured (mg/L)	RCRA Regulatory Limit (mg/L)
Arsenic	0.90	5.0
Barium	0.68	100.0
Cadmium	0.37	1.0
Chromium	0.096	5.0
Lead	460.0	5.0
Mercury	ND[1]	0.2
Selenium	ND[2]	1.0
Silver	1.7	5.0

[1] Method detection limit of 0.002 mg/L
[2] Method detection limit of 0.01 mg/L.

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Table 7. Results of TOC Analysis of Soil and Sediment Samples,
NL Industries Site,
December, 1992.

Sample Location	TOC Concentration (mg/kg)
E17	> 30000 *
E12	> 30000 *
E29	> 30000 *
E16	> 30000 *
EE1A	> 30000 *
P1	3725
P2	2650
P3	7675
P4	4075
P5	6325
W18	> 30000 *
W20	> 30000 *
W12	> 30000 *
W2	> 30000 *
S4	> 30000 *
S2	> 30000 *
S13	> 30000 *
S11	> 30000 *

* Denotes that the subcontract laboratory reported that due to the nature of the sample, an appropriate quantity could not be used in the analysis to meet the upper detection limits.

TABLE 8. Results of Grain Size Analysis of Soil and Sediment[1]
NL Industries Site
December, 1992

Sample Location	Sand					Total Sand	Silt	Clay
	Very Coarse	Coarse	Medium	Fine	Very Fine			
E12	3.2	11.2	34.6	27.6	9.4	86.0	12.6	1.4
E16	2.8	10.4	33.1	27.3	8.1	81.7	16.0	2.3
E17	2.3	8.0	35.9	26.8	7.1	80.1	13.6	2.3
E29	2.7	10.1	32.1	28.1	10.1	83.1	15.6	1.3
EE1A	8.7	11.6	13.1	13.2	6.3	52.9	41.3	1.5
P1	4.7	8.4	29.1	14.0	4.1	60.3	13.3	21.1
P2	6.6	14.7	24.1	13.0	12.3	70.7	10.1	15.8
P3	1.8	9.8	35.5	28.1	8.4	83.6	12.9	2.7
P4	1.4	7.3	32.9	34.5	11.1	87.2	11.4	1.3
P5	3.4	6.0	19.7	19.6	10.9	59.6	16.5	17.2
S2	15.2	10.4	19.0	17.1	8.1	69.8	23.6	6.6
S4	10.8	13.4	26.5	19.1	7.4	77.2	17.3	5.5
S11	10.0	10.1	27.3	26.1	10.9	84.4	14.0	1.6
S13	10.1	7.8	25.9	22.6	8.5	74.9	18.7	6.4
W2	7.0	9.6	29.4	25.7	8.2	79.9	17.1	2.9
W12	16.9	12.6	14.1	10.0	4.6	58.2	30.0	11.8
W18	1.4	5.3	16.1	12.2	7.4	42.4	31.5	21.8
W20	6.0	11.0	13.8	10.1	6.0	46.9	30.3	22.9

[1]All values reported in percent of total sample.

Figures

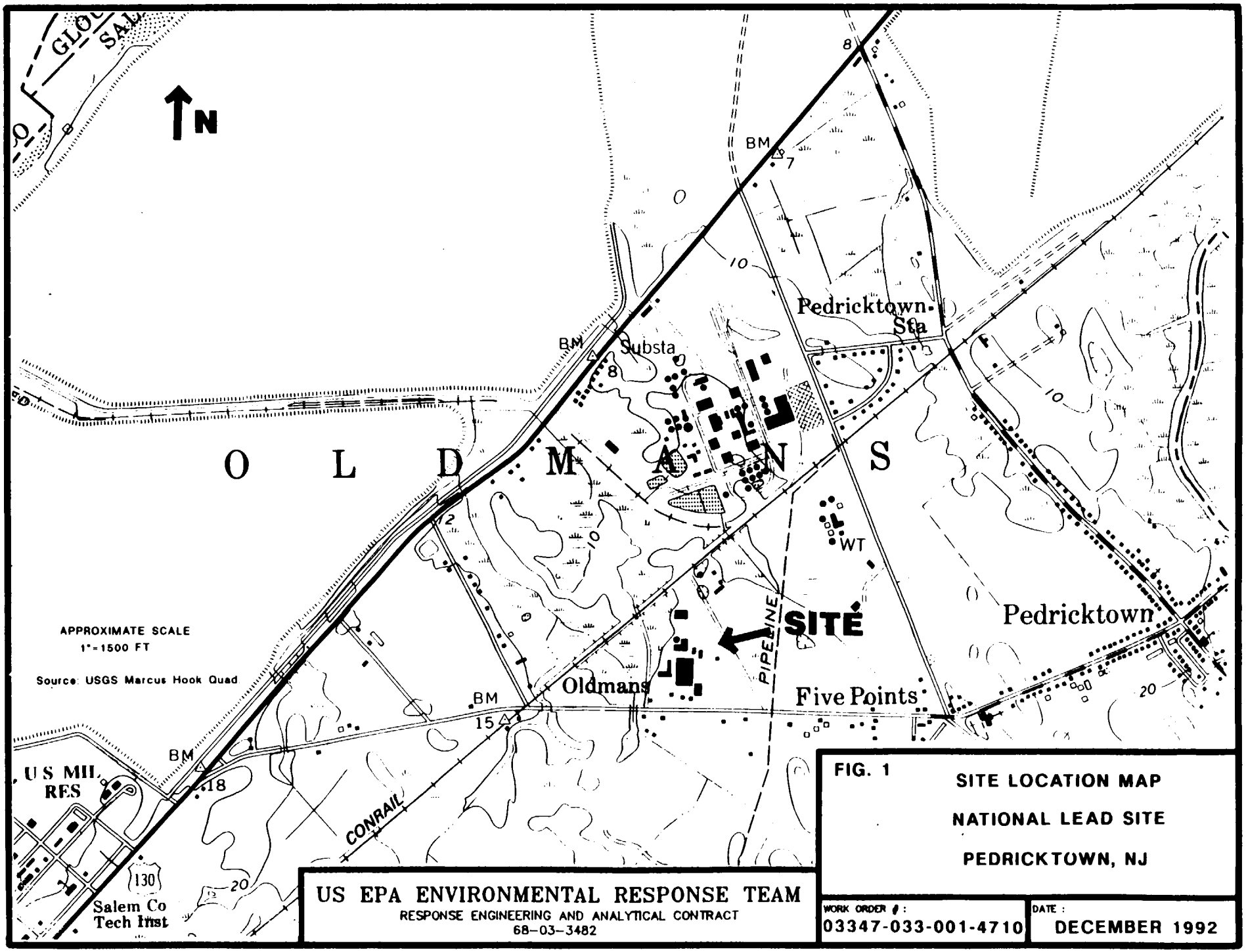


FIG. 1

SITE LOCATION MAP

NATIONAL LEAD SITE

PEDRICKTOWN, NJ

US EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

68-03-3482

WORK ORDER # :
03347-033-001-4710

DATE :
DECEMBER 1992

NLI 002 0455

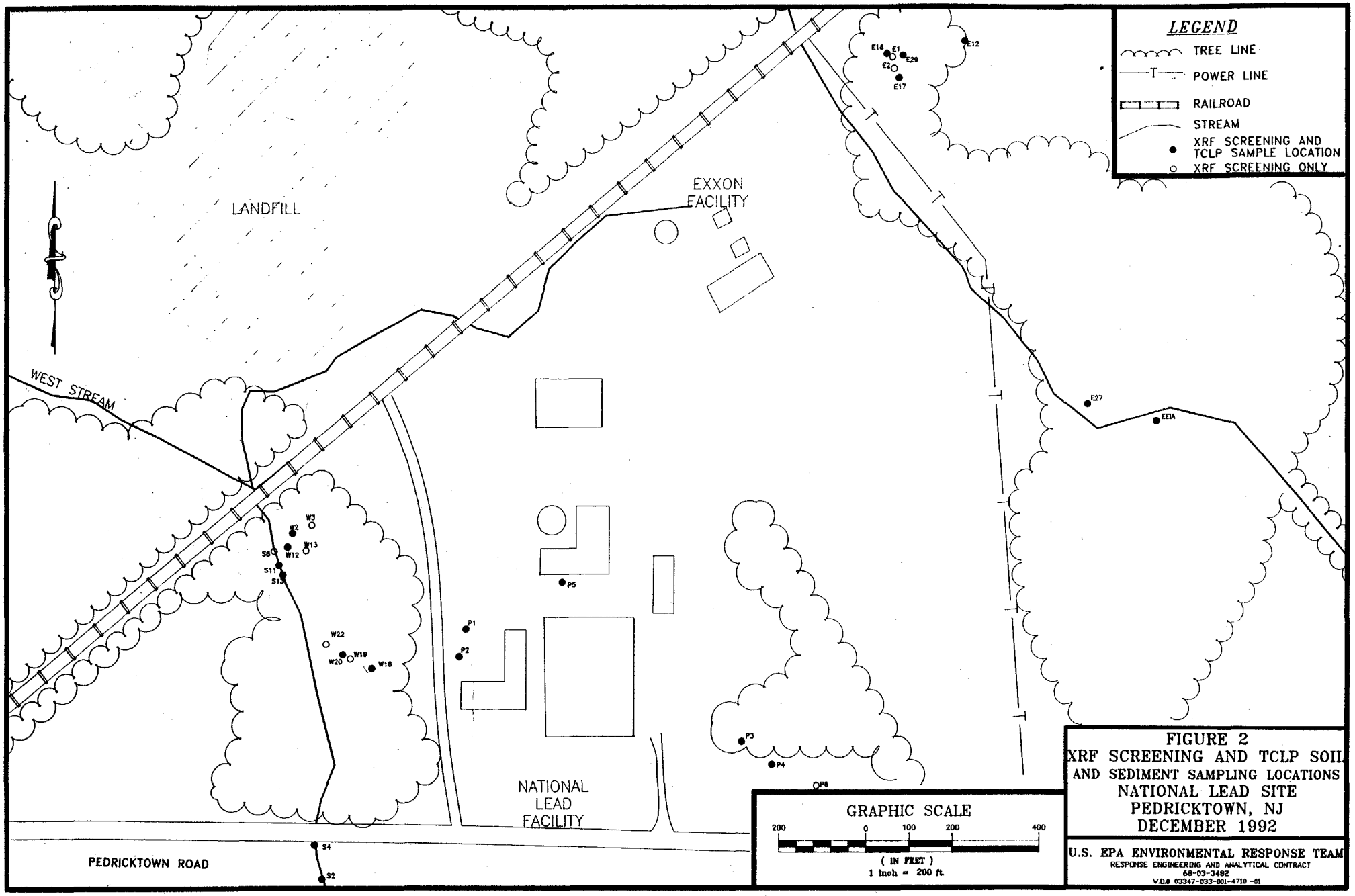


FIGURE 2
XRF SCREENING AND TCLP SOIL AND SEDIMENT SAMPLING LOCATIONS
NATIONAL LEAD SITE
PEDRICKTOWN, NJ
DECEMBER 1992

U.S. EPA ENVIRONMENTAL RESPONSE TEAM
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-03-3482
W.O.# 03347-033-001-4710 -01

Appendix A

APPENDIX A
REAC ANALYTICAL REPORT
NL Industries Site
Final Report
February, 1993

FR-4710/pb

ANALYTICAL REPORT

Prepared by
Roy F. Weston, Inc.

National Lead
Pedricktown, NJ

February 1, 1993

EPA Work Assignment No. 3-710
Weston Work Order No. 03347-033-001-4710-01
EPA Contract No. 68-03-3482

Submitted to
M. Sprenger
EPA-ERT

1/26/93
P. Bovitz — Date
Task Leader

Vinod Kansal 1/28/93
V. Kansal — Date
S. & A. Section Chief

1/29/93
W. S. Butterfield — Date
Project Manager

Analysis by:
ATEC

Prepared by:
G. Karustis

Reviewed by:
M. Barkley

Table of Contents

Appendices will be furnished on request

INTRODUCTION

REAC Laboratory, in response to Work Assignment # 3-710, provided analytical support for soil samples collected from the National Lead Site, Pedricktown, MD. This support included the analyses of environmental samples as summarized in the table below, QA/QC data review, and preparation of an analytical report. The analytical report includes a summary of the analytical methods, the results, QA/QC methods, and the QA/QC results.

The samples are summarized in the following table:

COC #*	Number of Samples	Sampling Date	Date Received	Matrix	Analysis	Laboratory
7532	9	12/8/92	12/16/92	Soil	Metals, TCLP Metals	ATEC**
7532	9	12/9/92	12/16/92	Soil	Metals, TCLP Metals	ATEC**
7533	9	12/8/92	12/16/92	Soil	Grain Size	ATEC**
7533	9	12/8/92	12/16/92	Soil	Total Organic Carbon	ATEC**
7534	9	12/9/92	12/16/92	Soil	Grain Size	ATEC**
7534	9	12/9/92	12/16/92	Soil	Total Organic Carbon	ATEC**

* COC # denotes Chain of Custody number
** ATEC denotes ATEC Environmental Associates

CASE NARRATIVE

The subcontract laboratory stated that due to the peaty nature of the samples (a very high organic content), very small sample sizes were used in the total organic carbon analysis. This led to variability in the replicates. The organic content was so high that even with the small sample quantities, the range of the instrument was exceeded.

The subcontract laboratory reported the results of the metals analysis on an "as received" basis.

ANALYTICAL PROCEDURE FOR METALS

The subcontract laboratory determined the metals content of the samples using methods found in "Test Methods for Evaluating Solid Wastes", SW-846, 3rd Edition, November, 1986. The results are listed in Table 1.1.

ANALYTICAL PROCEDURE FOR METALS IN TCLP

The subcontract laboratory determined the metals content of the TCLP extracts using TCLP Extract Method 1311 found in the Federal Register 40 CFR, Part 261, Appendix II, 29 June 1990. The results are listed in Table 1.2.

ANALYTICAL PROCEDURE FOR TOTAL ORGANIC CARBON

The subcontract laboratory determined the total organic carbon content of the samples using Method 9060 found in "Test Methods for Evaluating Solid Wastes", SW-846, 3rd Edition, November, 1986. The results are listed in Table 1.3.

ANALYTICAL PROCEDURE FOR GRAIN SIZE

The subcontract laboratory determined the grain size distribution of the samples using ASTM Method D422. The results are listed in Table 1.4 and Graph 1.1.

Table 1.1 Results of the Metals Analysis
WA # 3-710 National Lead
(based on wet weight)

Sample ID	A18814	A18815	A18816	A18817	A18818	A18819	A18820	A18821	A18822	MDL
Location	E17	E12	E29	E16	W12	W2	EE1A	P1	P2	
% Solids	85	78	83	81	34	54	41	89	90	
Analyte	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	(mg/kg)
Arsenic	5.4	4.4	5.0	6.8	19	7.0	5.2	5.4	3.0	2.0
Barium	6.8	18	9.0	9.2	26	32	14	23	13	2.0
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0
Chromium	7.5	8.4	7.8	8.8	7.3	4.8	38	9.5	16	2.0
Lead	420	380	270	440	780	100	380	170	96	2.0
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0

Sample ID	A18823	A18824	A18825	A18826	A18827	A18828	A18829	A18830	A18831	MDL
Location	P3	P4	P5	W18	W20	S4	S2	S13	S11	
% Solids	91	90	92	79	45	41	38	36	38	
Analyte	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	Conc (mg/kg)	(mg/kg)
Arsenic	19	10	14	52	56	4.0	ND	50	30	2.0
Barium	27	12	30	89	47	24	10	31	15	2.0
Cadmium	2.2	3.3	20	23	4.6	2.1	ND	6.8	10	2.0
Chromium	9.8	6.7	14	26	20	7.6	5.0	6.9	4.9	2.0
Lead	3600	1000	16000	15000	5100	730	140	4900	2200	2.0
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0

ND denotes Not Detected
MDL denotes Method Detection Limit

Table 1.2 Results of the TCLP Metals Analysis
WA # 3-710 National Lead

Sample ID	A18814	A18815	A18816	A18817	A18818	A18819	A18820	A18821	A18822	MDL
Location	E17	E12	E29	E16	W12	W2	EE1A	P1	P2	
Analyte	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	(mg/l)
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.050
Barium	ND	0.12	ND	ND	0.11	1.0	ND	0.14	0.23	0.050
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.010
Chromium	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.050
Lead	0.55	0.72	0.42	0.57	0.90	0.24	0.45	0.48	2.9	0.050
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.010
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.050

Sample ID	A18823	A18824	A18825	A18826	A18827	A18828	A18829	A18830	A18831	MDL
Location	P3	P4	P5	W18	W20	S4	S2	S13	S11	
Analyte	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	Conc (mg/l)	(mg/l)
Arsenic	ND	ND	ND	ND	ND	ND	ND	0.85	0.50	0.050
Barium	0.069	0.095	0.10	0.33	0.27	0.21	0.055	0.68	0.16	0.050
Cadmium	ND	0.049	0.29	0.37	0.026	ND	ND	0.074	0.066	0.010
Chromium	ND	ND	ND	0.096	ND	ND	ND	ND	ND	0.050
Lead	43	3.3	460	120	18	1.4	0.96	43	11	0.050
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.010
Silver	ND	ND	ND	ND	1.2	ND	ND	ND	1.7	0.050

ND denotes Not Detected
MDL denotes Method Detection Limit

Table 1.3 Results of the Total Organic Carbon Analysis
WA # 3-710 National Lead
(based on wet weight)

Sample ID	Location	Conc (mg/kg)	Range of four Analyses (mg/kg)	Method Detection Limit (mg/kg)
Blank		ND		22
B18814	E17	> 30000 #		22
B18815	E12	> 30000 #		22
B18816	E29	> 30000 #		22
B18817	E16	> 30000 #		22
B18818	W12	> 30000 #		22
B18819	W2	> 30000 #		22
B18820	EE1A	> 30000 #		22
B18821	P1	3725 *	2200-4400	22
B18822	P2	2650 *	2400-3000	22
B18823	P3	7675 *	6800-8300	22
B18824	P4	4075 *	2900-5900	22
B18825	P5	6325 *	5600-7200	22
B18826	W18	> 30000 #		22
B18827	W20	> 30000 #		22
B18828	S4	> 30000 #		22
B18829	S2	> 30000 #		22
B18830	S13	> 30000 #		22
B18831	S11	> 30000 #		22

* denotes that this value is the average of four replicates

\# denotes that the subcontract laboratory claimed that due to the nature of the sample an appropriate quantity could not be used in the analysis

Table 1.4 Results of the Grain Size Analysis
WA # 3-710 National Lead

Sample ID		C18814	C18815	C18816	C18817	C18818	C18819	C18820	C18821	C18822
Location		E17	E12	E29	E16	W12	W2	EE1A	P1	P2
Standard Sieve Size	Sieve Size (u)	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*
	0.5 in									97.9
	0.375 in								99.6	97.7
4	4760								97.6	95.5
8	2380								94.7	92.3
10	2000	99.8	99.1	99.6	99.3	99.0	99.0	96.7	93.6	91.1
16	1190	97.7	96.8	97.3	97.2	83.1	93.0	91.3	90.0	85.7
30	590	85.7	85.6	87.2	86.8	70.5	83.4	79.7	81.6	71.0
40	420	69.1	70.0	73.2	72.5	63.9	71.4	72.2	69.5	58.3
50	297	49.8	51.0	55.1	53.7	56.4	53.9	64.6	52.5	46.9
80	177	28.7	30.0	34.0	32.5	49.0	34.3	56.8	41.3	38.2
100	149	23.0	23.4	27.0	26.4	46.4	28.2	53.4	38.5	33.9
200	74	15.9	14.0	16.9	18.3	41.8	20.0	47.1	34.4	21.6
	Diameter (mm)	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*
	0.0356									15.1
	0.0349						24.4			
	0.0347		12.5							
	0.0346					38.4				
	0.0345	13.3			13.3					
	0.0341								28.6	
	0.0338			16.3						
	0.0329							50.5		
	0.0233						5.1			
	0.0226		7.5		7.3					
	0.0225	8.3				18.5				15.1
	0.0222			10.3						
	0.0221							28.2		
	0.0217								26.7	
	0.0135						2.9			
	0.0134	3.3	2.4	2.3						
	0.0133				4.3			10.8		
	0.0131					14.0				13.3
	0.0126								24.9	
	0.0096		1.4				2.9			
	0.0095	2.3		2.3	3.3			8.4		
	0.0093					11.8				11.5
	0.0090								23.0	
	0.0068		1.4	1.3			2.9			
	0.0067	2.3			2.3			5.8		
	0.0066					11.8				11.5
	0.0064								21.1	
	0.0034	1.1	1.2	1.1			2.5			
	0.0033				1.6	11.4		7.8		11.1
	0.0032								18.9	
	0.0014	0.7	0.7	0.2	0.7	4.8	0.4	4.2		
	0.0013								14.3	7.5

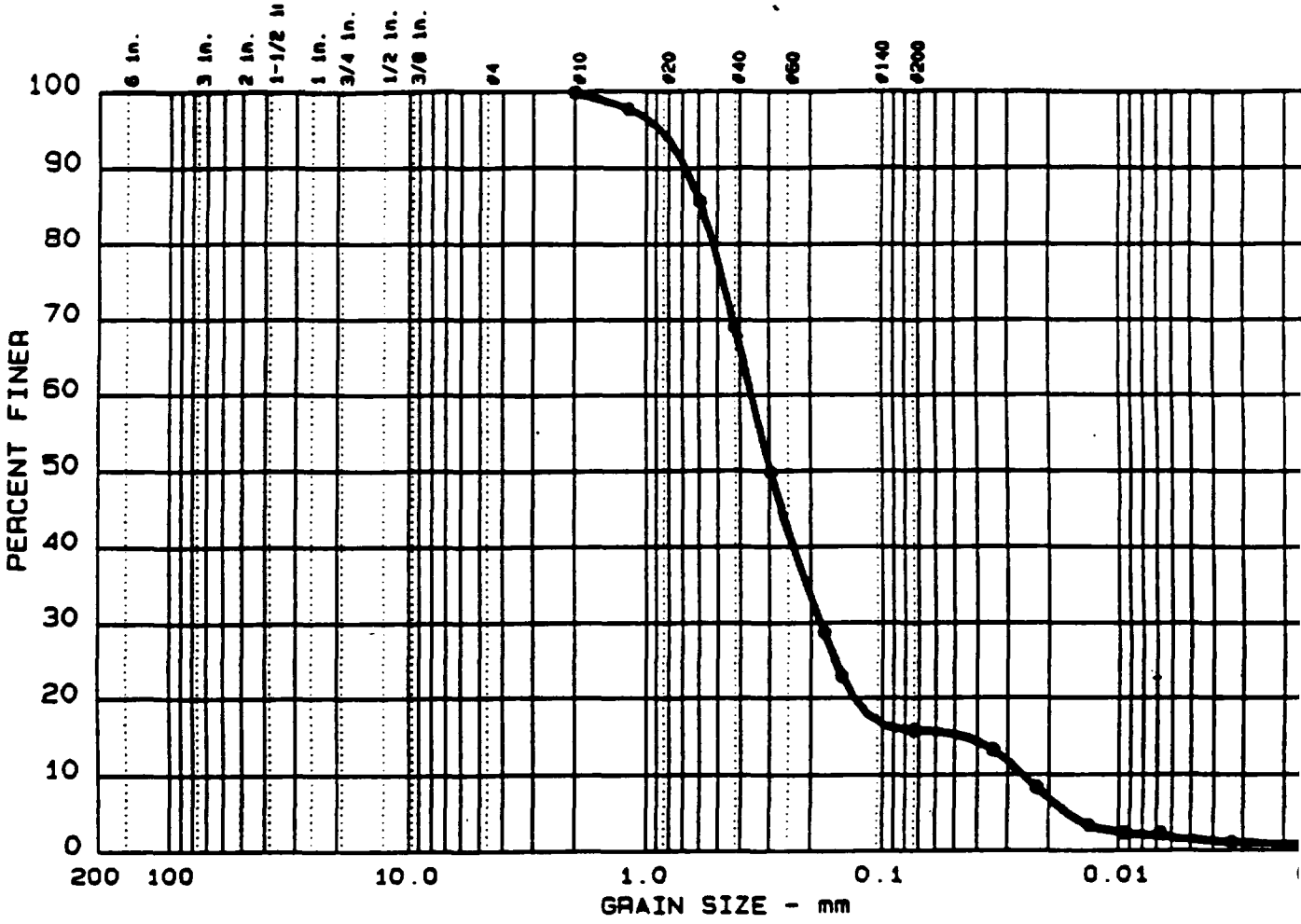
* denotes Cumulative Percent Through

Table 1.4 Results of the Grain Size Analysis
MA # 3-710 National Lead

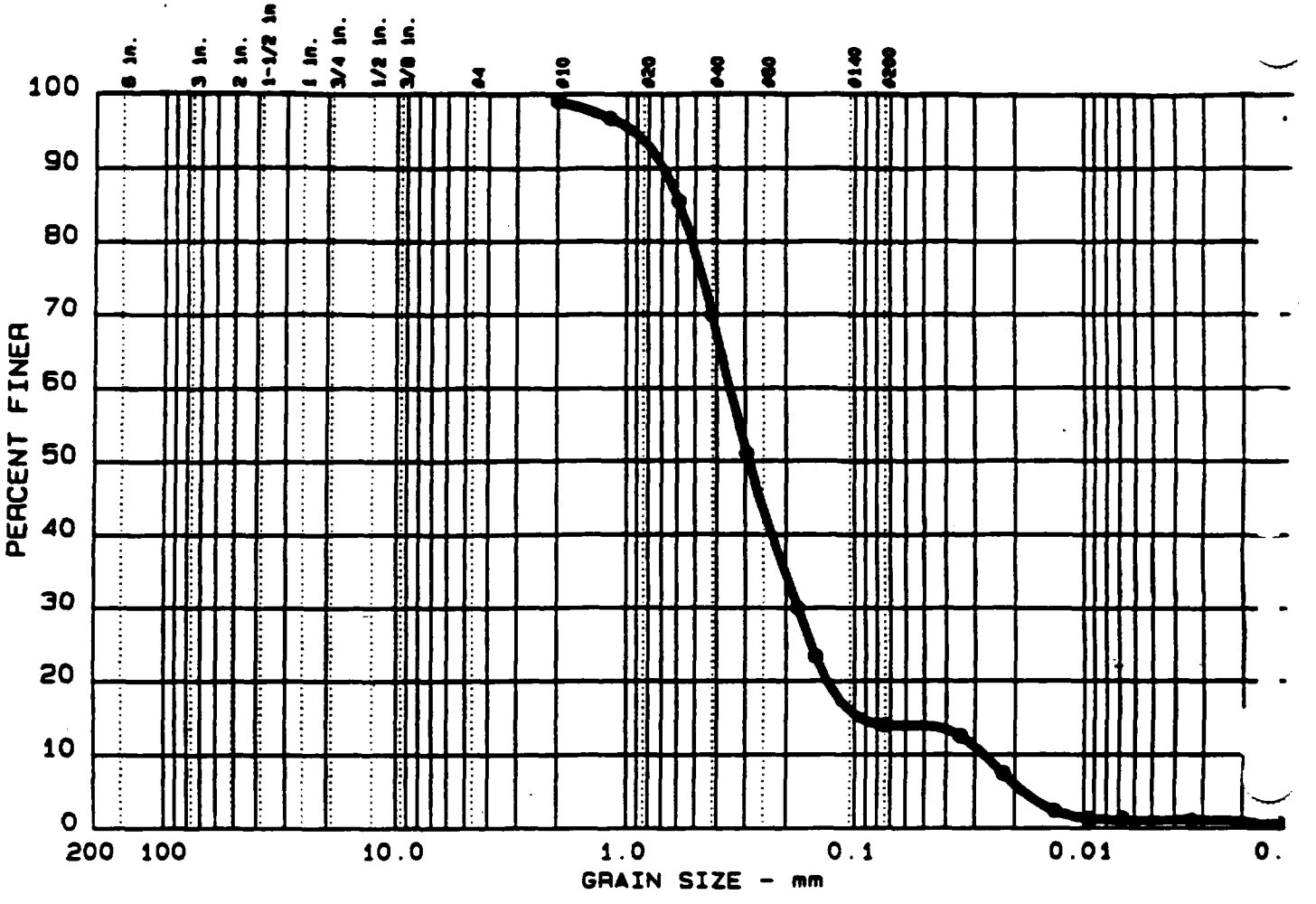
Sample ID		C18823	C18824	C18825	C18826	C18827	C18828	C18829	C18830	C18831
Location		P3	P4	P5	W18	W20	S4	S2	S13	S11
Standard Sieve Size	Sieve Size (u)	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*
	0.5 in			99.4	96.4					
	0.375 in			98.3						
4	4760	99.4	100.0	95.7	95.9					
8	2380	99.2	99.8	93.3	95.7					
10	2000	99.1	99.7	92.5	95.5	99.1	94.8	91.2	92.4	93.6
16	1190	97.4	98.4	89.9	94.3	94.1	89.2	84.8	89.9	90.0
30	590	87.6	91.1	83.9	89.0	83.1	75.8	74.4	82.1	79.9
40	420	73.4	79.0	75.8	82.2	76.1	62.9	65.7	71.8	68.4
50	297	52.1	58.2	64.2	72.9	69.3	49.3	55.4	56.2	52.6
80	177	30.2	32.1	50.6	63.7	62.1	35.3	43.2	39.3	33.9
100	149	24.0	23.8	44.6	60.7	59.2	30.2	38.3	33.6	26.5
200	74	15.6	12.7	33.7	53.3	53.2	22.8	30.2	25.1	15.6
	Diameter (mm)	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*	CPCT*
	0.0368		4.7							
	0.0364	8.6								8.3
	0.0356						16.2			
	0.0354								17.8	
	0.0345			24.5				26.1		
	0.0332					47.3				
	0.0325				42.8					
	0.0234		2.7							
	0.0232	6.6								6.4
	0.0228						12.3		12.1	
	0.0224							18.3		
	0.0221			20.8						
	0.0218					32.6				
	0.0210				37.1					
	0.0136		0.7							
	0.0135	2.7								3.6
	0.0133							9.5		
	0.0132						10.4		10.2	
	0.0128			19.0		25.3				
	0.0124				31.3					
	0.0096	2.7	0.7							2.6
	0.0094						7.5	8.5	8.3	
	0.0091			18.1		25.3				
	0.0089				25.6					
	0.0068	2.7	0.7							1.6
	0.0067						5.5	6.6	6.4	
	0.0065			17.2		22.9				
	0.0064				21.8					
	0.0034	2.3	1.3				2.2	2.2		2.2
	0.0033					15.0			3.1	
	0.0032			14.9	14.7					
	0.0014	1.3	-0.6				-0.6	1.3	1.3	-0.6
	0.0013			10.4	7.0	6.5				

* denotes Cumulative Percent Through

Graph 1.1 Results of the Grain Size Distribution for Sample C 18814 (E17)
WA # 3-710 National Lead



Graph 1.1 Results of the Grain Size Distribution for Sample C 18815 (E12)
WA # 3-710 National Lead



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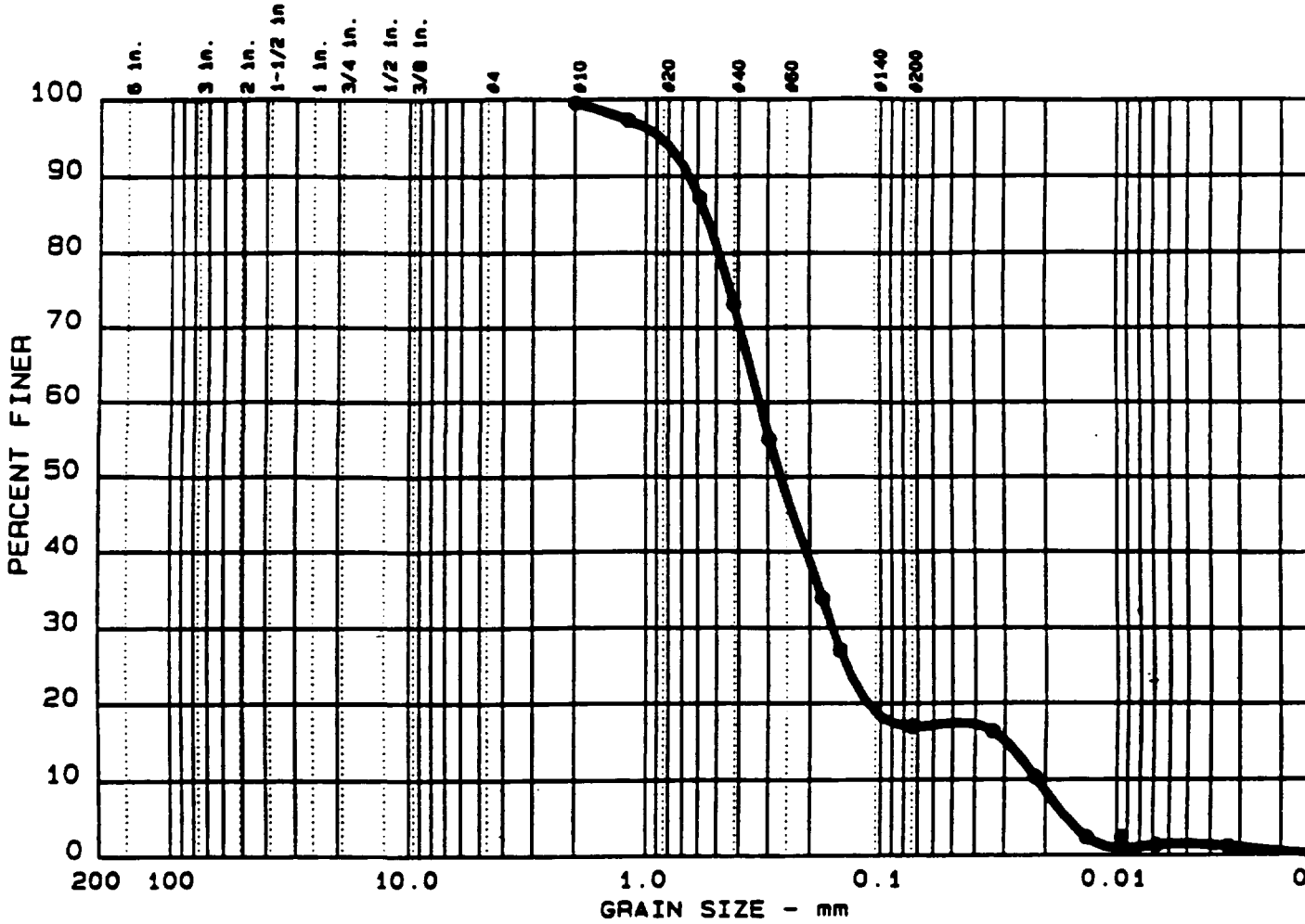
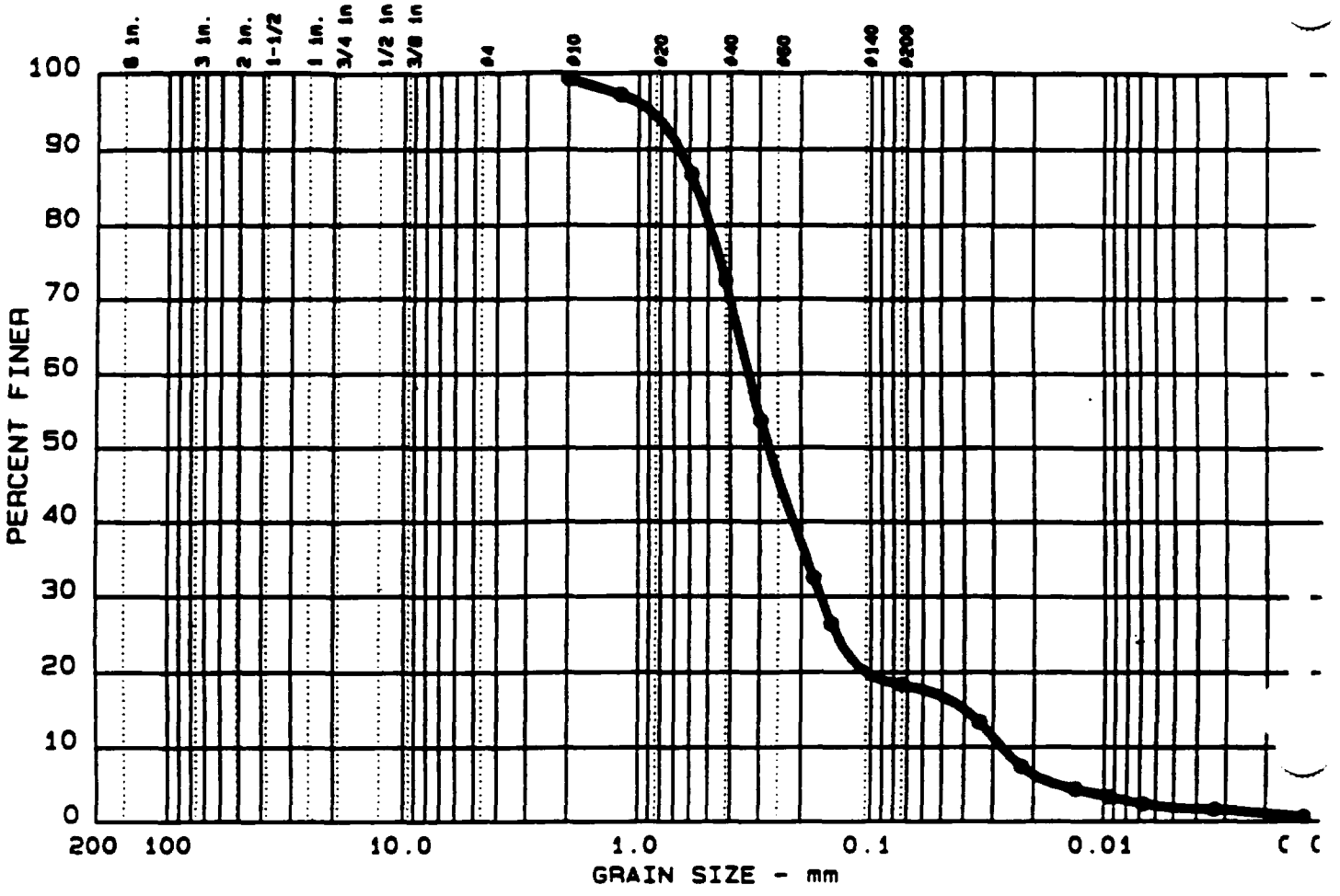
Graph 1.1 Results of the Grain Size Distribution for Sample C 18816 (E29)
WA # 3-710 National Lead



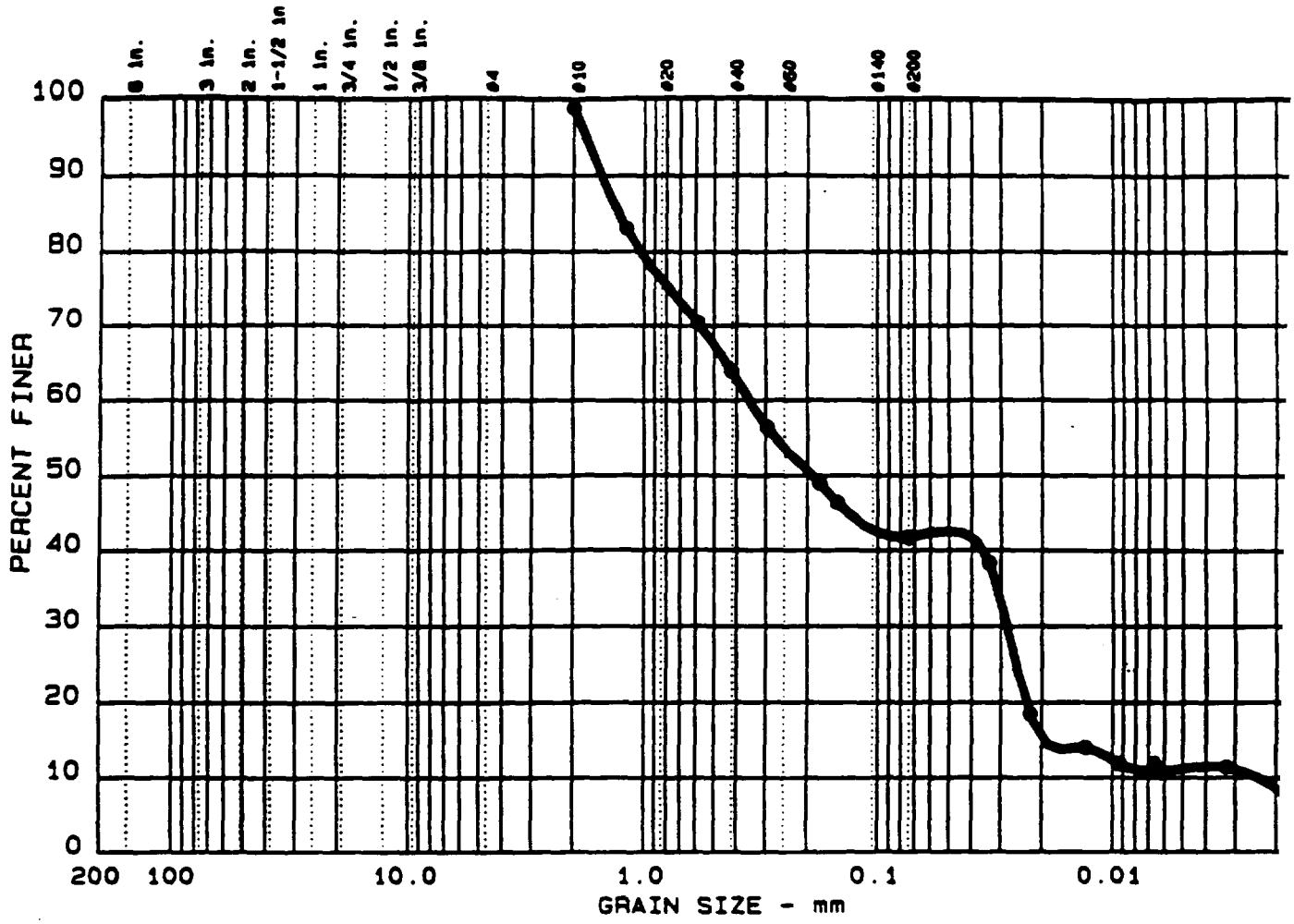
NLI 002 0470

Graph 1.1 Results of the Grain Size Distribution for Sample C 18817 (E16)
WA # 3-710 National Lead



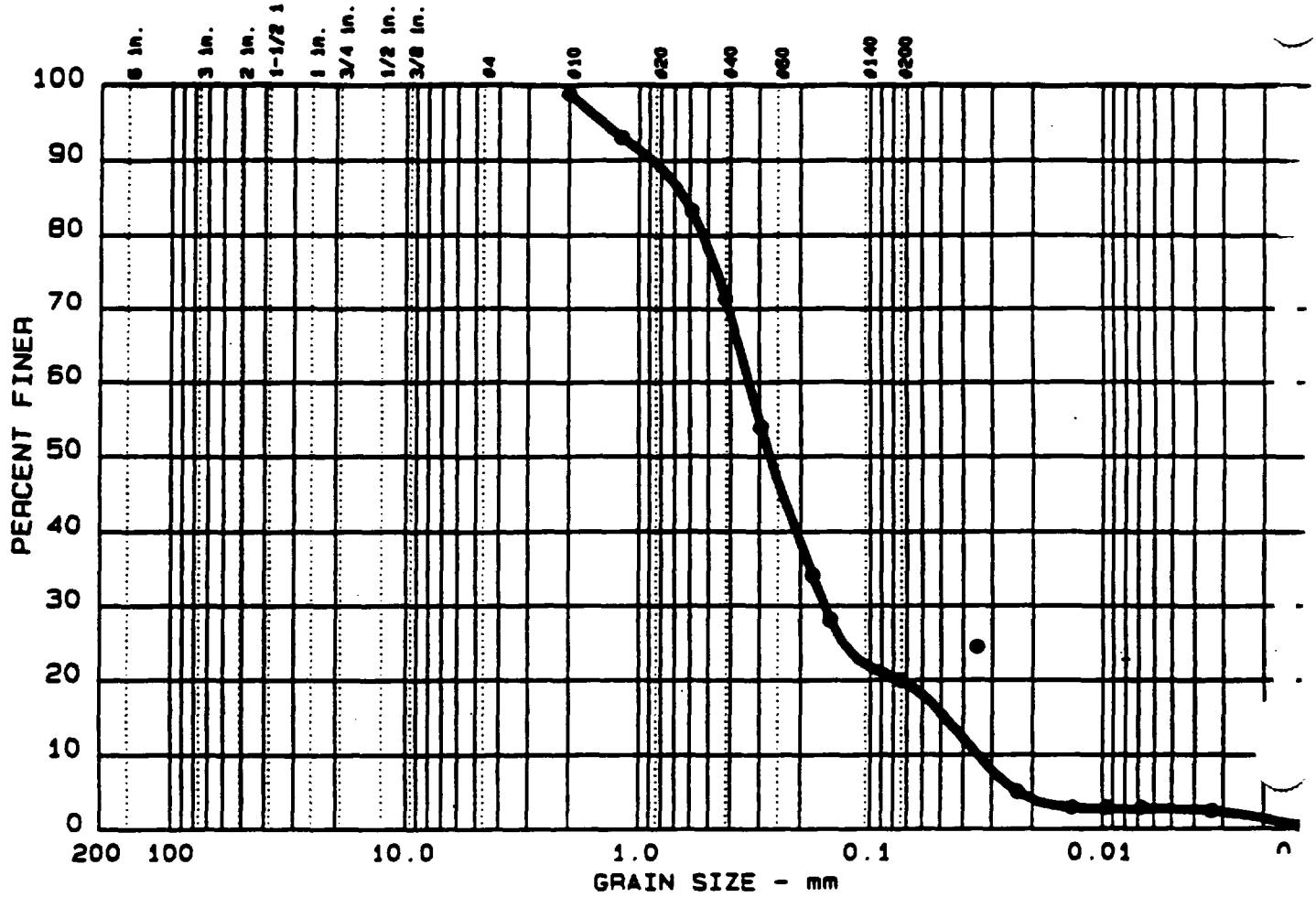
NLI 002 0471

Graph 1.1 Results of the Grain Size Distribution for Sample C 18818 (W12)
WA # 3-710 National Lead

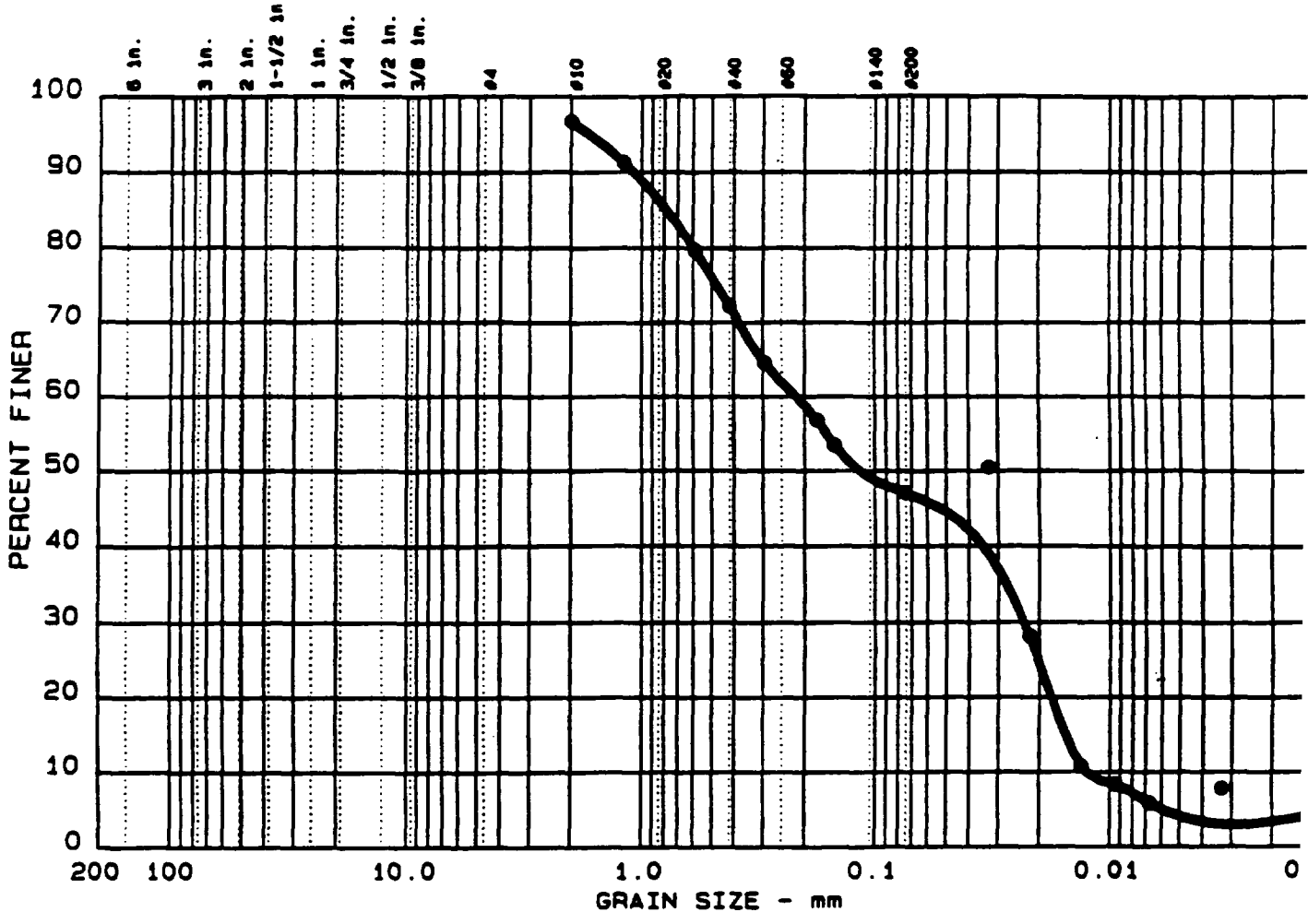


NLI 002 0472

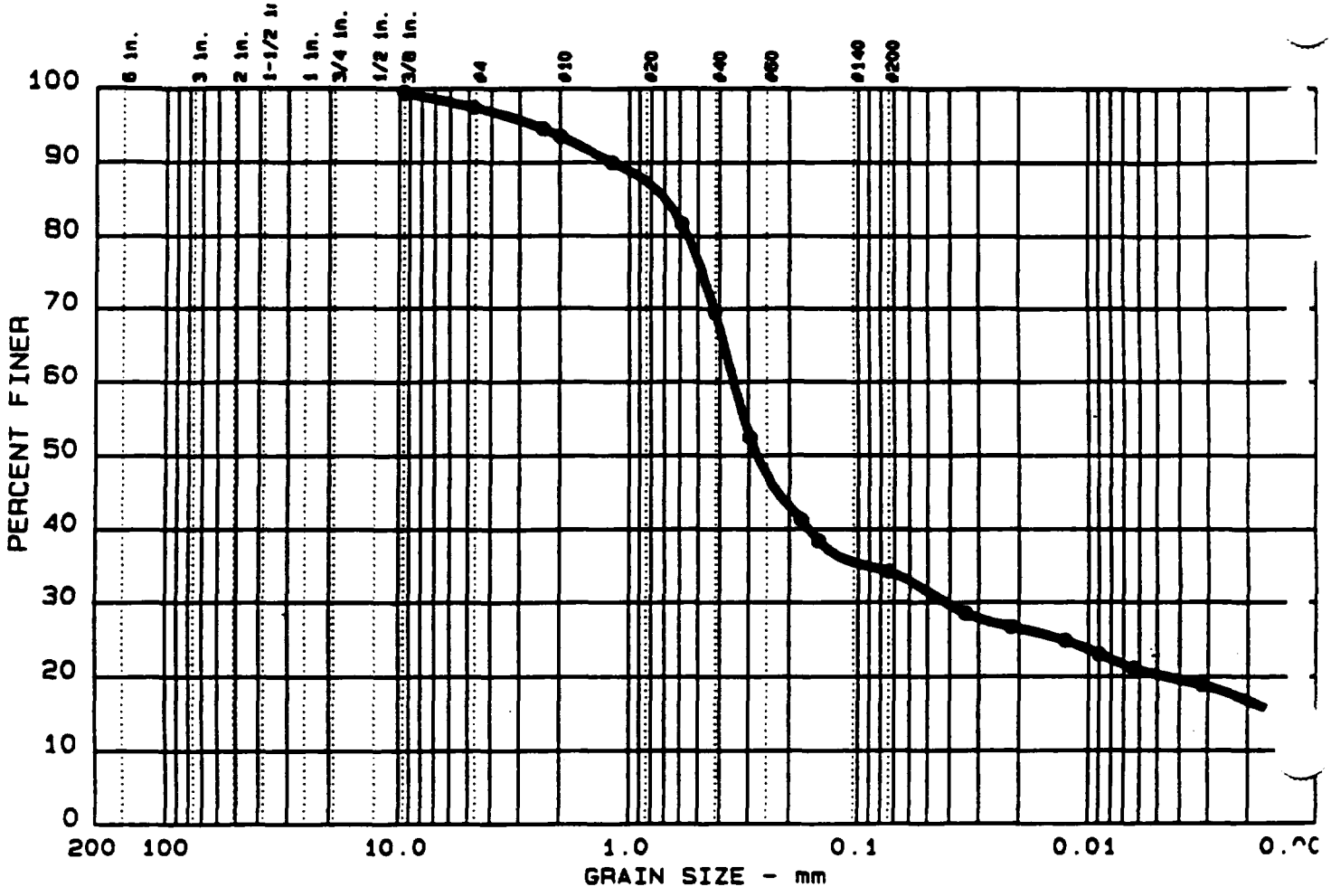
Graph 1.1 Results of the Grain Size Distribution for Sample C 18819 (W2)
WA # 3-710 National Lead



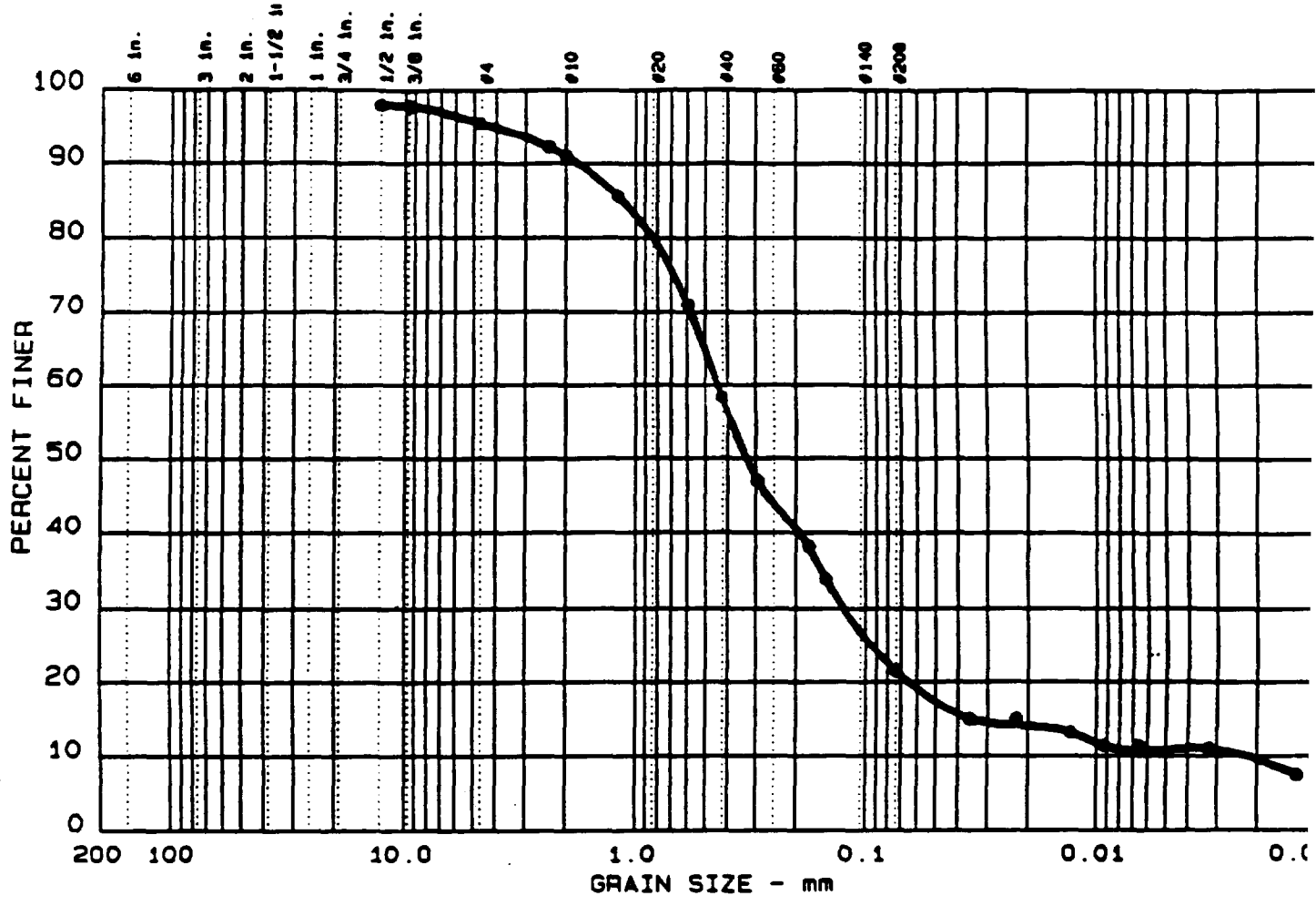
Graph 1.1 Results of the Grain Size Distribution for Sample C 18820 (EE1A)
WA # 3-710 National Lead



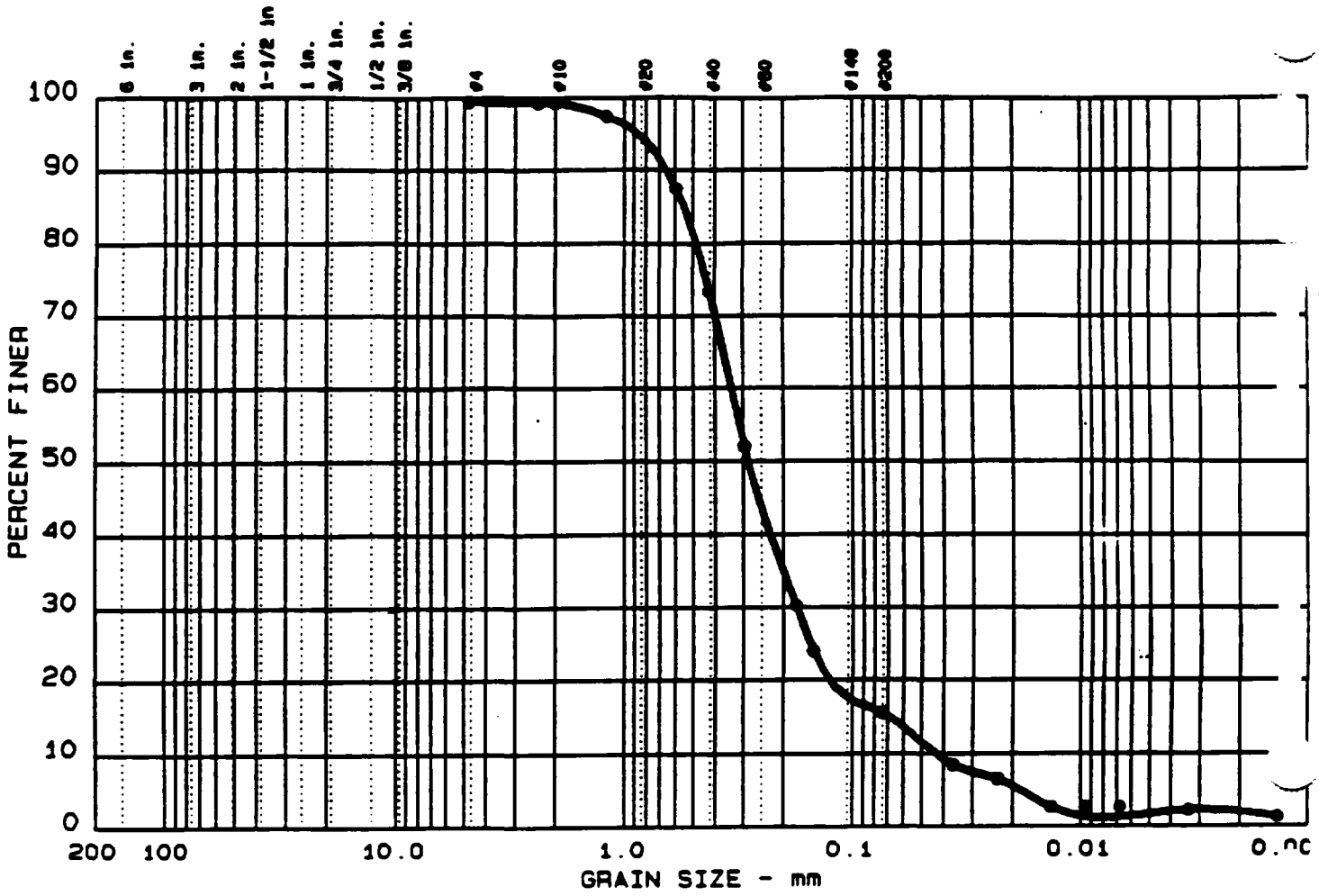
Graph 1.1 Results of the Grain Size Distribution for Sample C 18821 (P1)
WA # 3-710 National Lead



Graph 1.1 Results of the Grain Size Distribution for Sample C 18822 (P2)
WA # 3-710 National Lead



Graph 1.1 Results of the Grain Size Distribution for Sample C 18823 (P3)
WA # 3-710 National Lead



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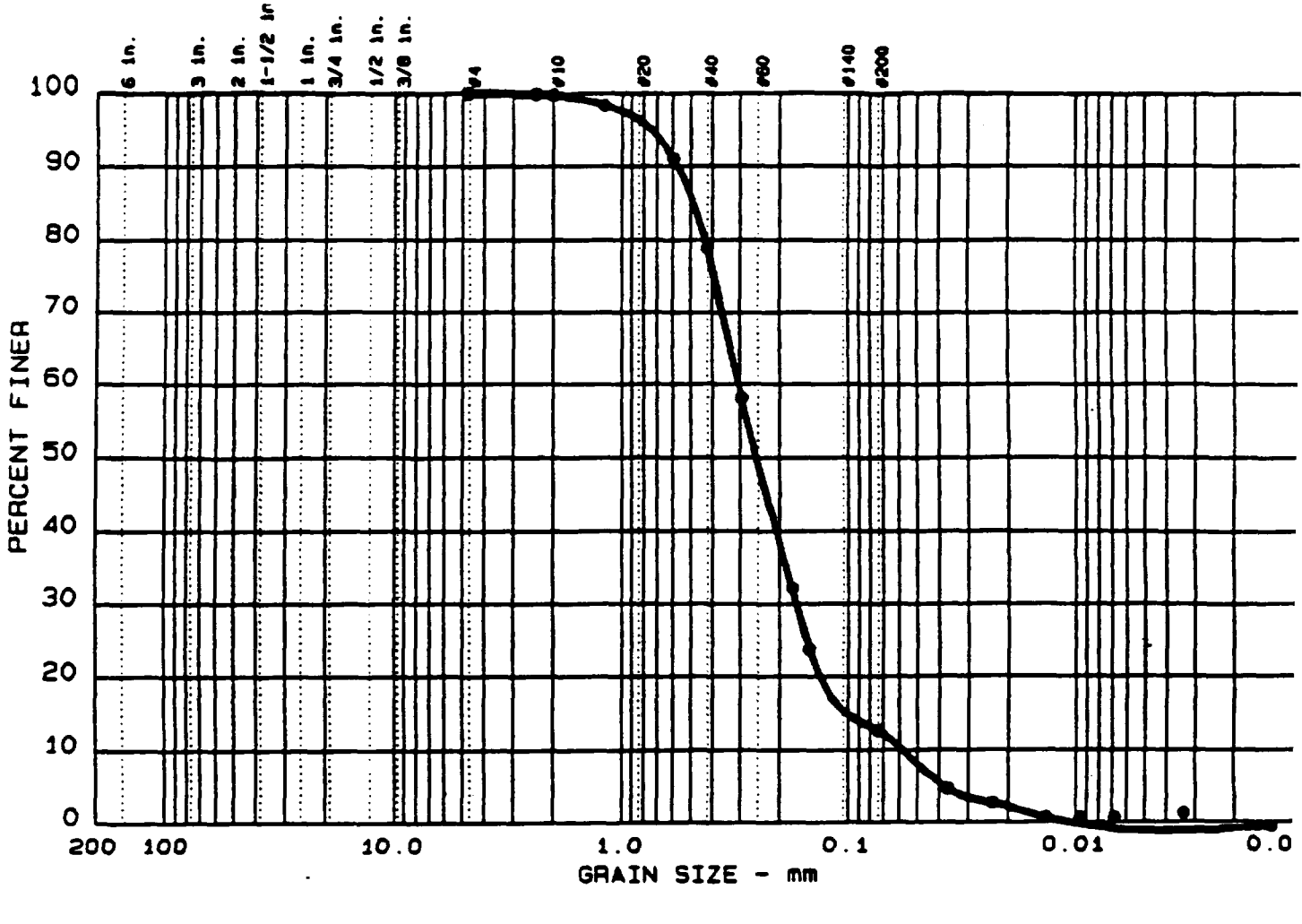
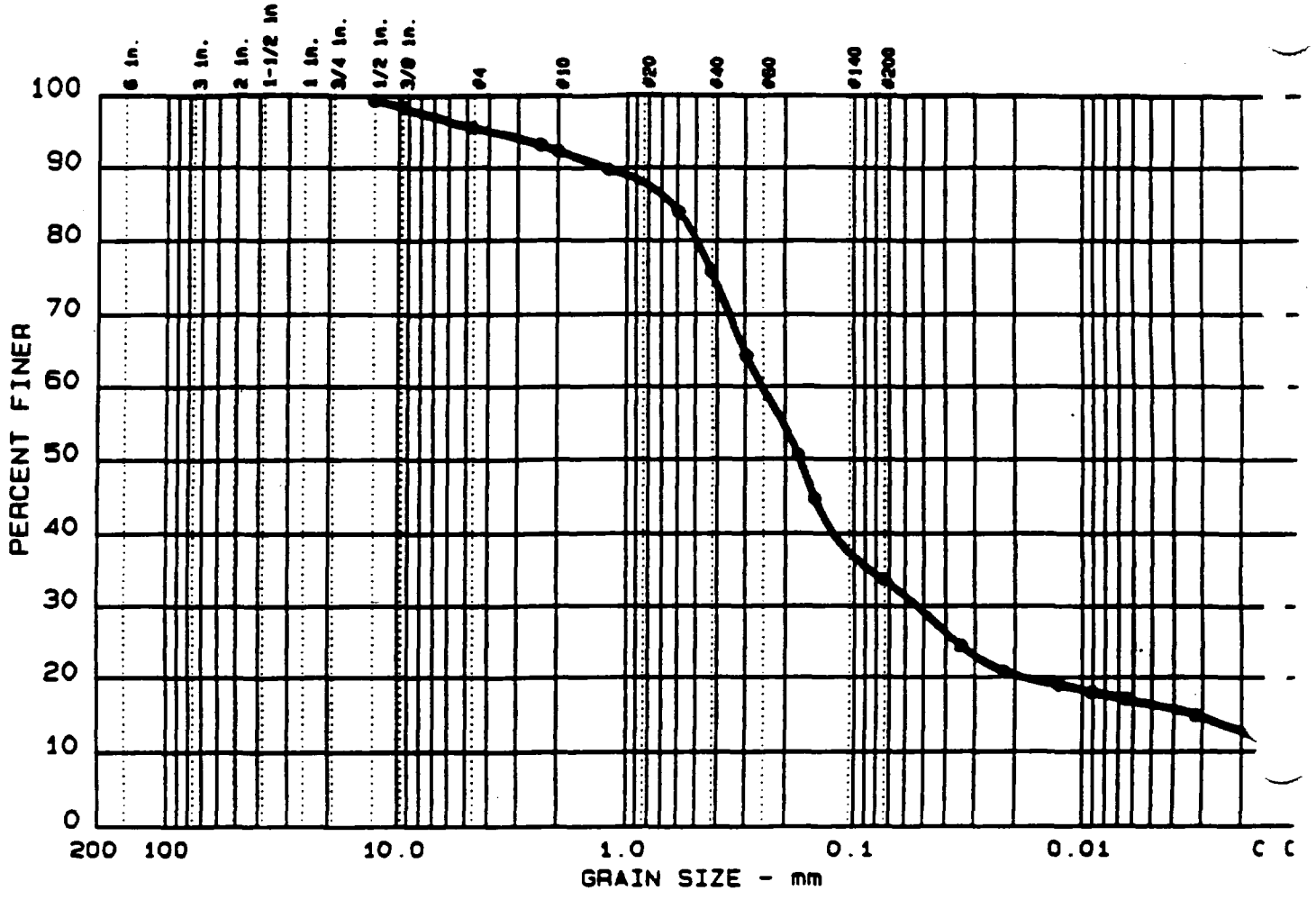
Graph 1.1 Results of the Grain Size Distribution for Sample C 18824 (P4)
WA # 3-710 National Lead



NLI 002 0478

Graph 1.1 Results of the Grain Size Distribution for Sample C 18825 (P5)
WA # 3-710 National Lead



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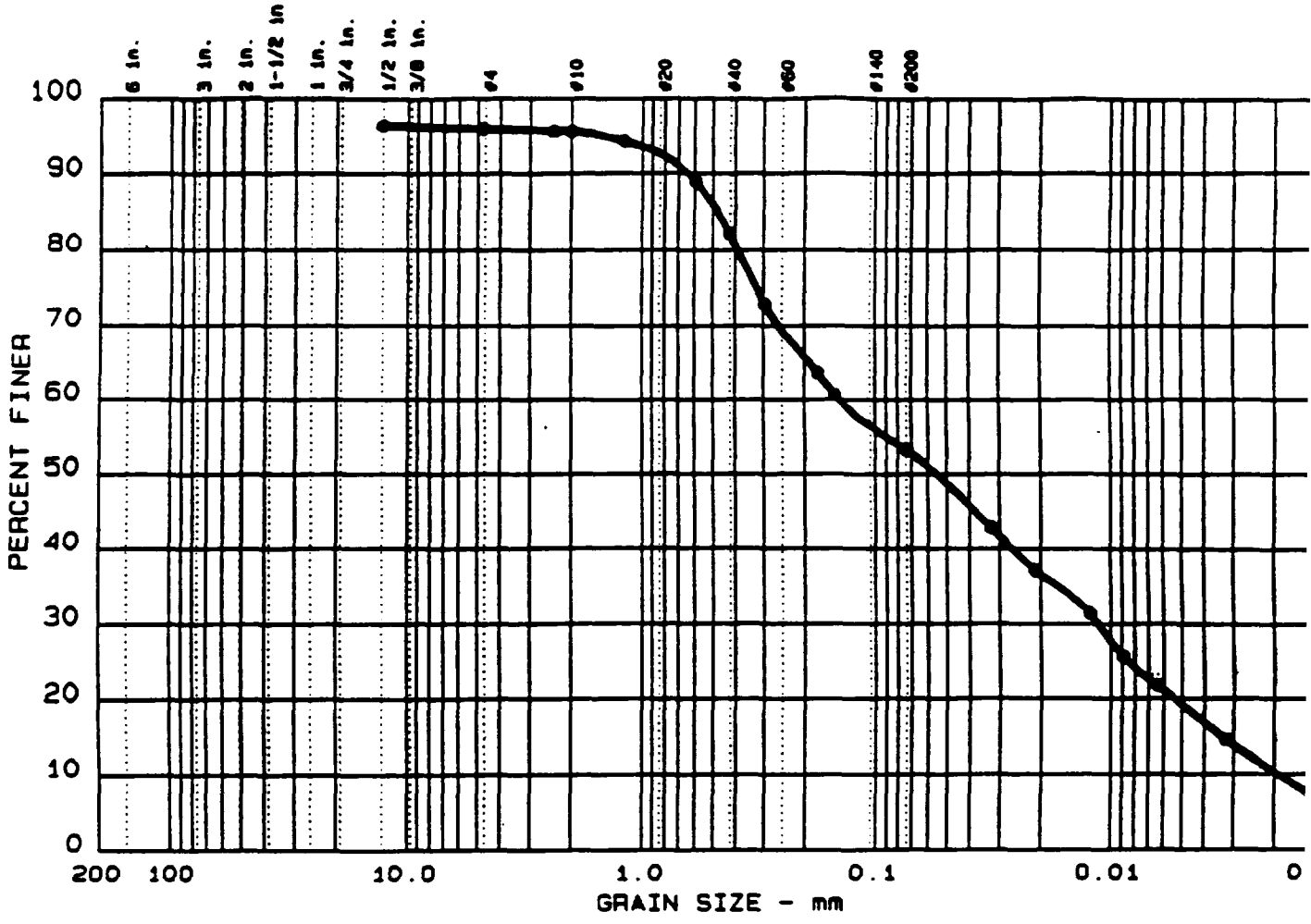
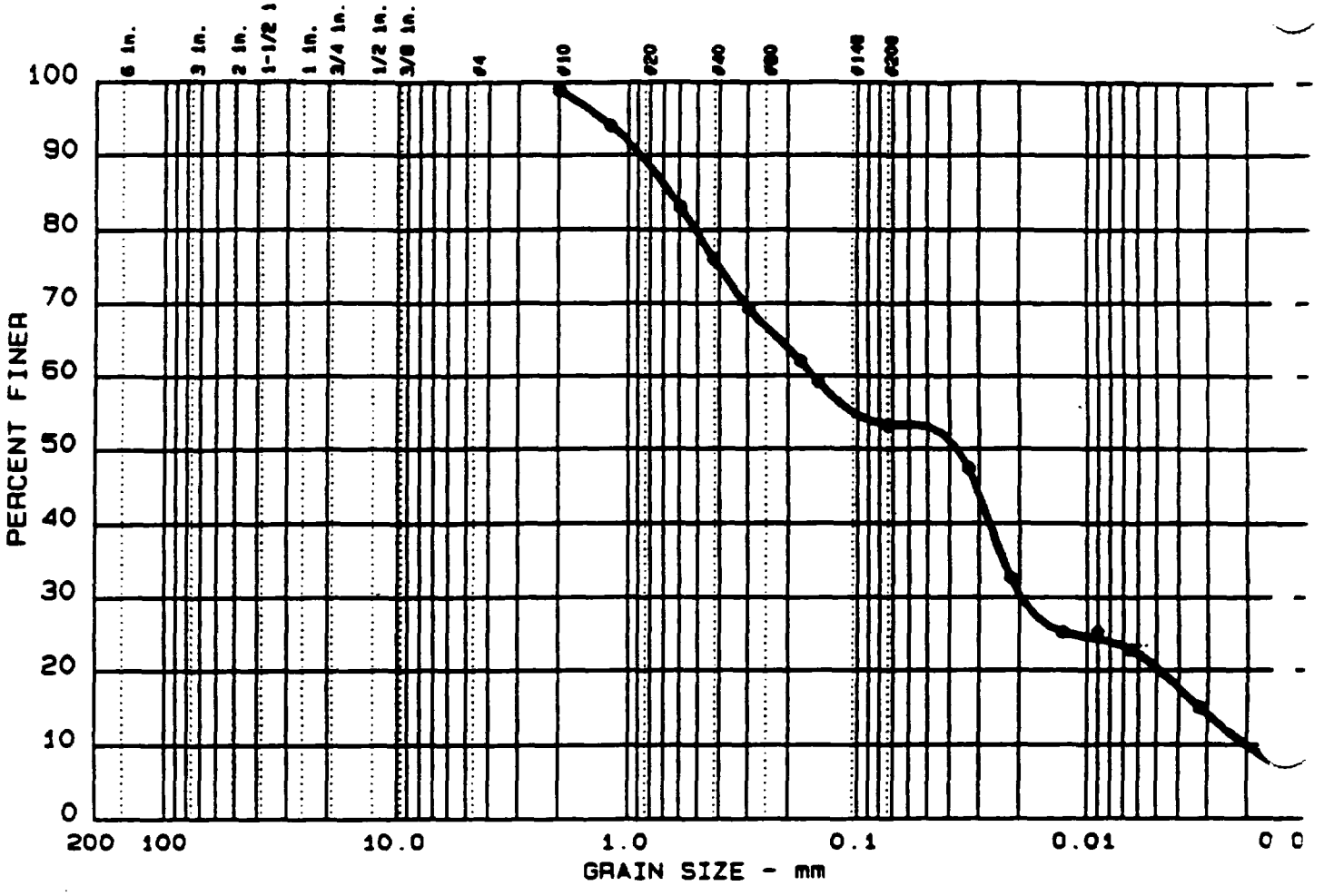
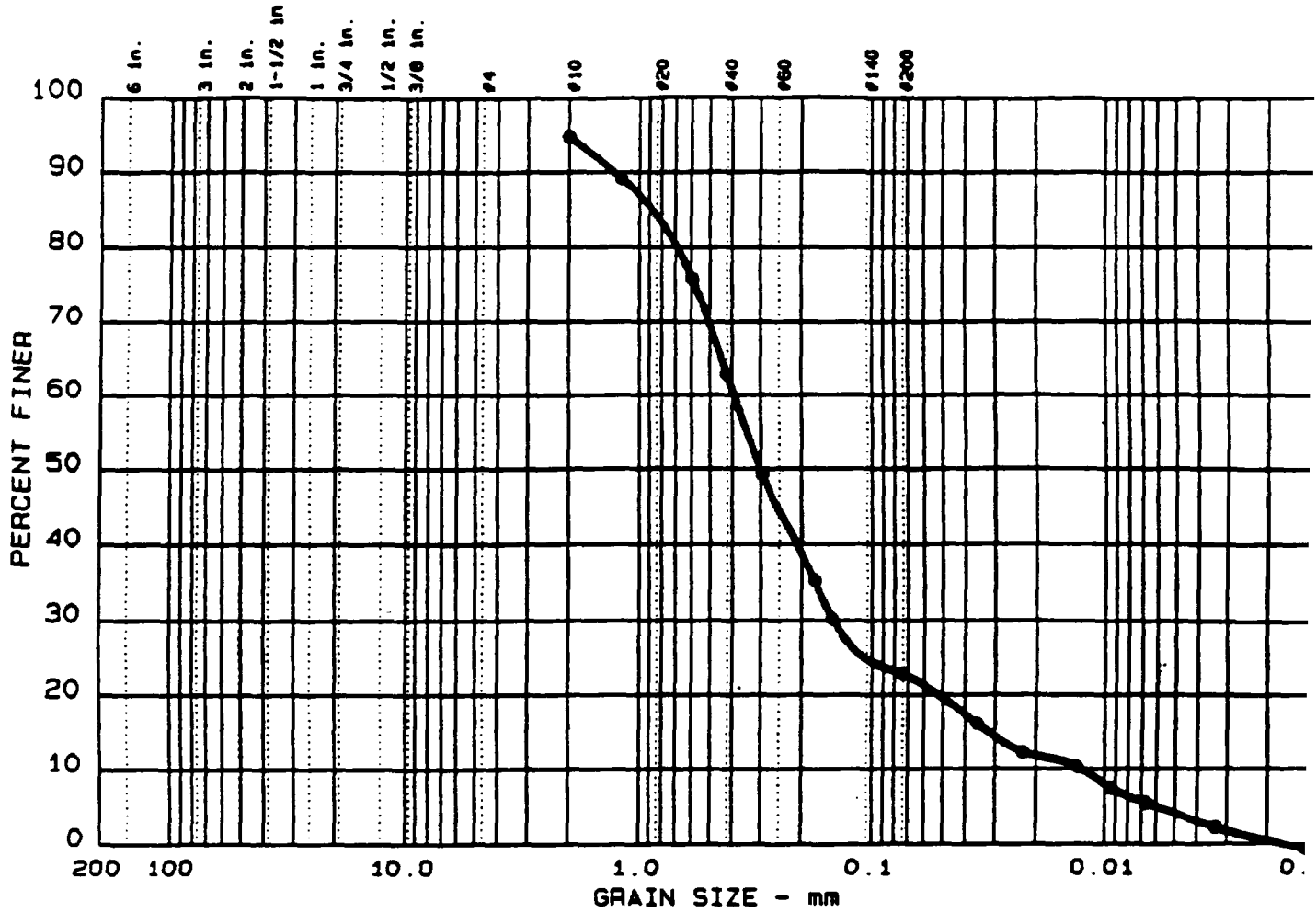
Graph 1.1 Results of the Grain Size Distribution for Sample C 18826 (W18)
WA # 3-710 National Lead



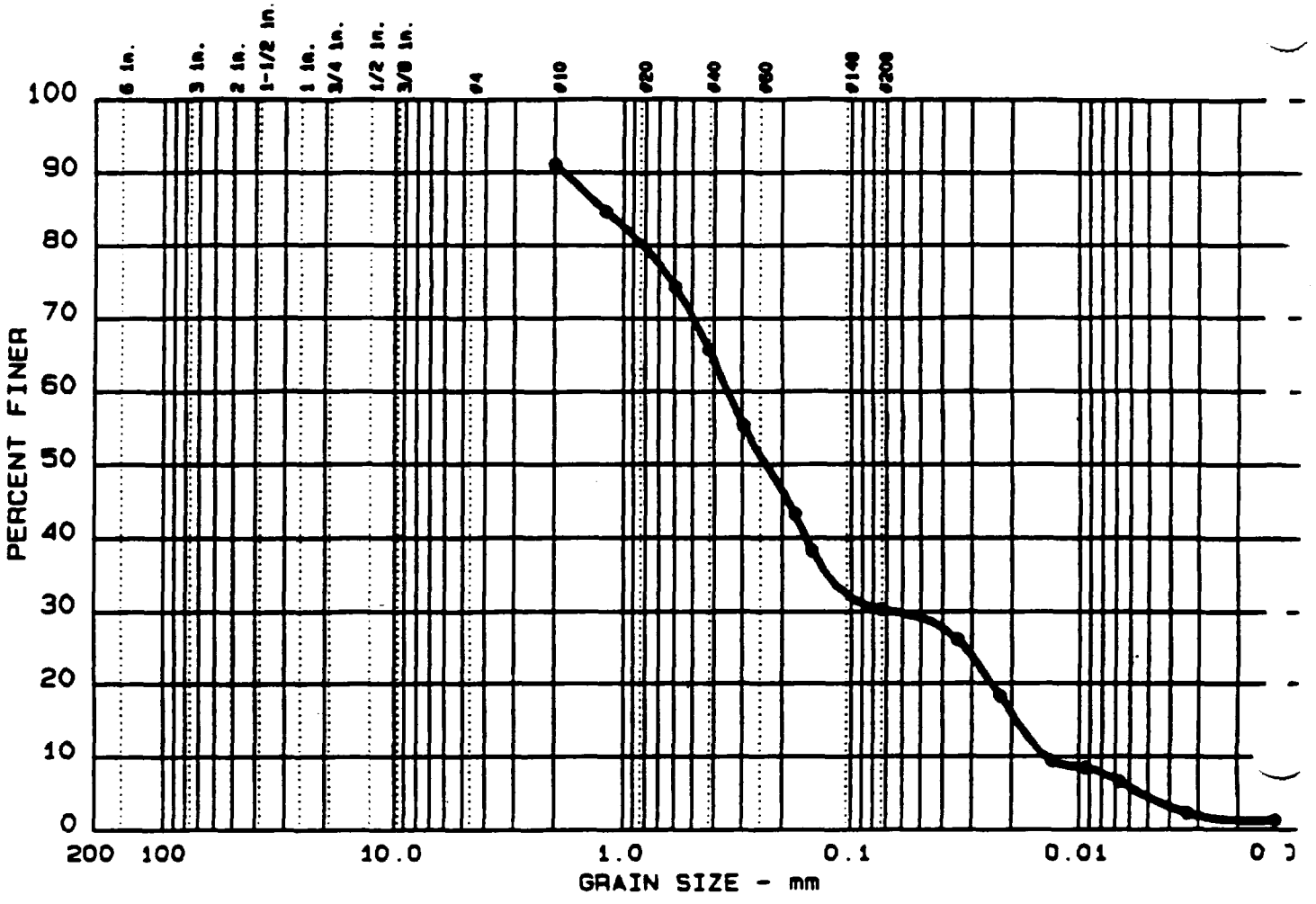
Graph 1.1 Results of the Grain Size Distribution for Sample C 18827 (W20)
WA # 3-710 National Lead



Graph 1.1 Results of the Grain Size Distribution for Sample C 18828 (S4)
WA # 3-710 National Lead

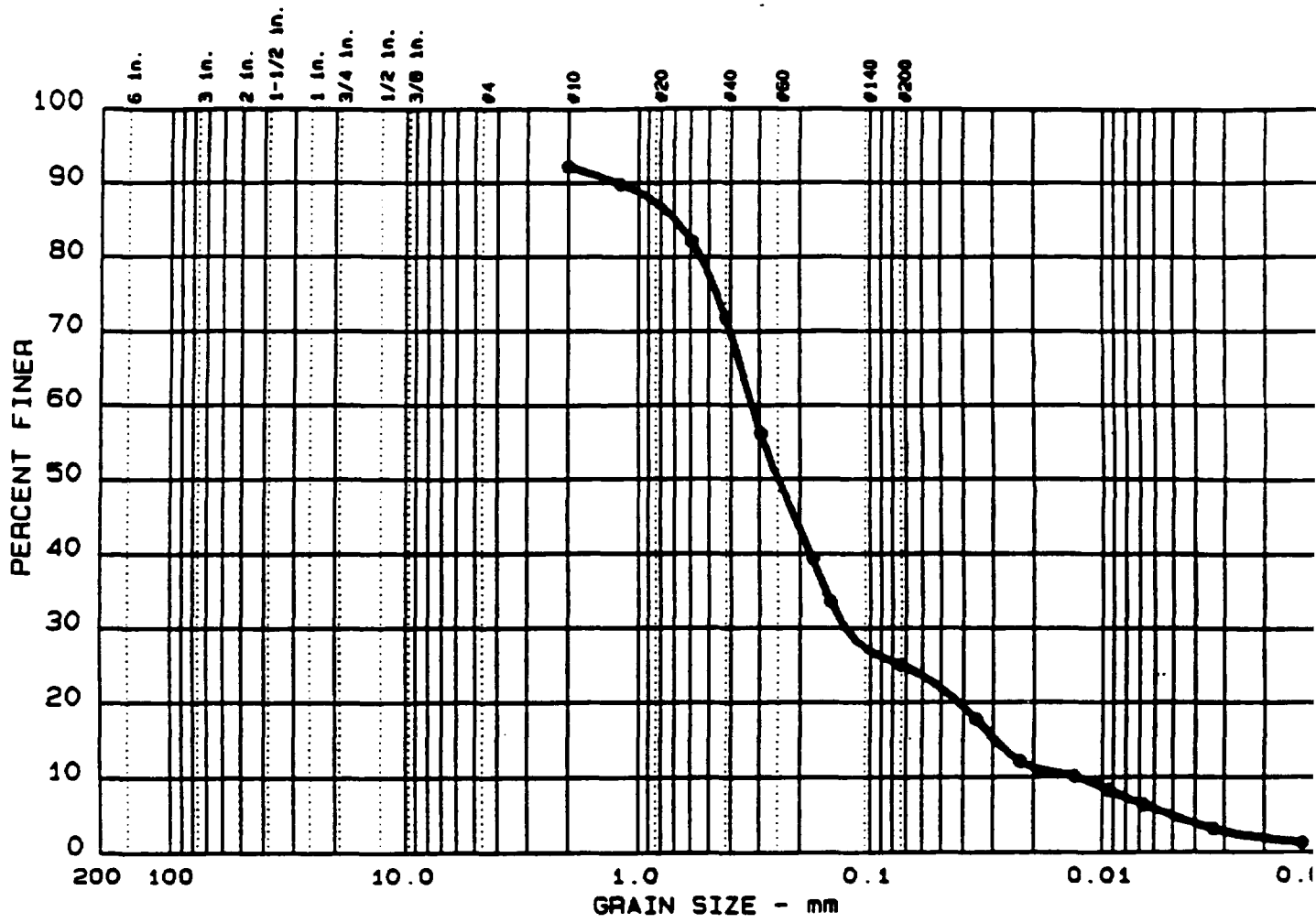


Graph 1.1 Results of the Grain Size Distribution for Sample C 18829 (S2)
WA # 3-710 National Lead

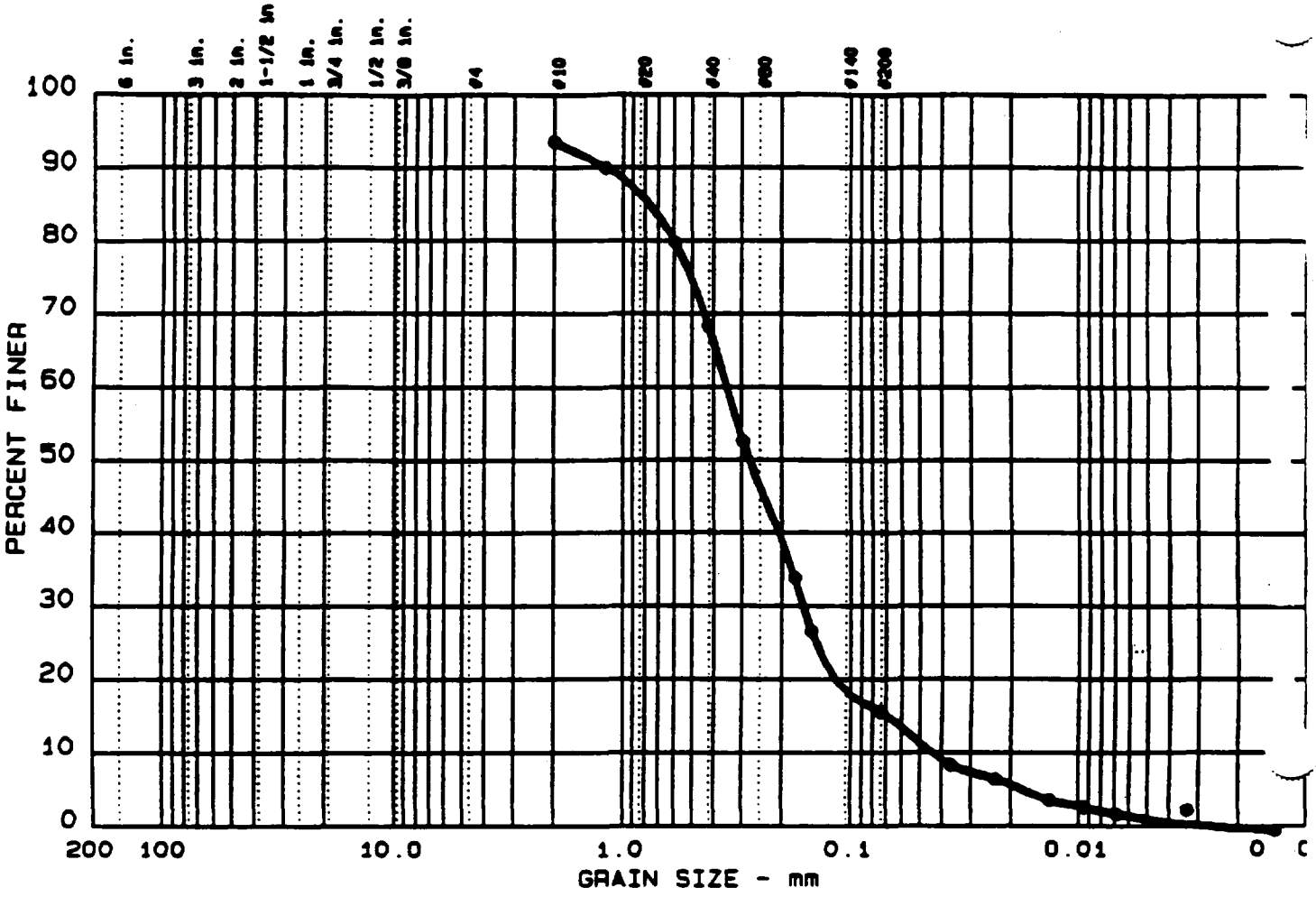


NLI 002 0483

Graph 1.1 Results of the Grain Size Distribution for Sample C 18830 (S13)
WA # 3-710 National Lead



Graph 1.1 Results of the Grain Size Distribution for Sample C 18831 (S11)
WA # 3-710 National Lead



QA/QC FOR METALS

Results of the Duplicate Analysis

Samples A 18818 and A 18825 were chosen for duplicate analyses. The relative percent differences for sample A 18818 ranged from 1 to 15. Four relative percent differences were not calculated because the analyte was not detected in either analysis. The relative percent differences for sample A 18825 ranged from 12 to 44. Three relative percent differences were not calculated because the analyte was not detected in either analysis. The results of the duplicate analyses are listed in Table 2.1.

Results of the Matrix Spike/Matrix Spike Duplicate Analysis

Samples A 18818 and A 18825 were chosen for matrix spike/matrix spike duplicate (MS/MSD) analyses. The percent recoveries, listed in Table 2.2, ranged from 58 to 150. The relative percent difference (RPDs), also listed in Table 2.2 ranged from 0 (zero) to 11. Six percent recoveries and three relative percent differences were not calculated because the concentration of analyte in the sample was greater than the concentration spiked.

Table 2.1 Results of the Duplicate Analysis
WA # 3-710 National Lead

Sample ID A 18818

Analyte	Initial Analysis Conc (mg/kg)	Duplicate Analysis Conc (mg/kg)	Relative Percent Difference
Arsenic	19	22	15
Barium	26	27	4
Cadmium	ND	ND	NC
Chromium	7.3	7.4	1
Lead	780	680	14
Mercury	ND	ND	NC
Selenium	ND	ND	NC
Silver	ND	ND	NC

Sample ID A 18825

Analyte	Initial Analysis Conc (mg/kg)	Duplicate Analysis Conc (mg/kg)	Relative Percent Difference
Arsenic	14	22	44
Barium	30	39	26
Cadmium	20	17	16
Chromium	14	12	15
Lead	16000	18000	12
Mercury	ND	ND	NC
Selenium	ND	ND	NC
Silver	ND	ND	NC

ND denotes Not Detected
NC denotes Not Calculated

Table 2.2 Results of the MS/MSD Analysis for the Metals
WA # 3-710 National Lead

Sample ID A 18818

Analyte	Sample Value (ppm)	Spike Added (ppm)	MS Value (ppm)	Percent Recovery (MS)	MSD Value (ppm)	Percent Recovery (MSD)	RPD
Arsenic	9.375	50	63.00	107	64.00	109	2
Barium	26.42	200	227.3	100	226.9	100	0
Cadmium	0.6106	5.0	6.806	124	7.026	128	3
Chromium	7.328	20	28.29	105	28.81	107	2
Lead	780.9	50	795	NC	807.1	NC	NC
Mercury	0.24	2.5	2.355	85	2.24	84	1
Selenium	ND	5.0	5.60	112	5.50	110	2
Silver	ND	5.0	3.208	64	2.879	58	11

Sample ID A 18825

Analyte	Sample Value (ppm)	Spike Added (ppm)	MS Value (ppm)	Percent Recovery (MS)	MSD Value (ppm)	Percent Recovery (MSD)	RPD
Arsenic	7.05	46.73	-	-	63.55	121	-
Arsenic	7.05	48.54	60.19	109	-	-	10
Barium	29.83	200	215.1	93	219.4	95	2
Cadmium	19.53	5.0	22.54	NC	23.94	NC	NC
Chromium	14.38	20	32.57	91	33.44	95	5
Lead	15930	50	12780	NC	16270	NC	NC
Mercury	0.038	2.380	2.743	114	-	-	-
Mercury	0.038	2.50			3.00	118	3
Selenium	ND	0.971	1.46	150			
Selenium	ND	0.935			1.40	150	0
Silver	0.3096	5.0	4.454	83	4.194	78	6

ND denotes Not Detected
NC denotes Not Calculated

Results of the Matrix Spike Analysis

Samples A 18818 and A 18825 were chosen for matrix spike (MS) analyses. The percent recoveries, listed in Table 2.3, ranged from 66 to 124.

The TCLP spikes were not run in duplicate and are bench spikes, not digestion spikes.

Table 2.3 Results of the MS Analysis for the TCLP
WA # 3-710 National Lead

Sample ID A 18818

Analyte	Sample Value (mg/l)	Spike Added (mg/l)	MS Value (mg/l)	Percent Recovery (MS)
Arsenic	ND	0.050	0.051	102
Barium	0.108	1.0	1.251	114
Cadmium	ND	1.0	1.159	116
Chromium	ND	1.0	1.207	121
Lead	0.896	2.0	3.347	123
Mercury	ND	0.005	0.00543	109
Selenium	ND	0.050	0.042	84
Silver	ND	1.0	1.091	109

Sample ID A 18825

Analyte	Sample Value (mg/l)	Spike Added (mg/l)	MS Value (mg/l)	Percent Recovery (MS)
Arsenic	0.022	0.050	0.062	80
Barium	0.100	1.0	1.151	105
Cadmium	0.291	1.0	1.348	106
Chromium	ND	1.0	1.11	111
Lead	5.369	2.0	7.856	124
Mercury	ND	0.005	0.0058	115
Selenium	ND	0.050	0.033	66
Silver	ND	1.0	1.015	102

ND denotes Not Detected
RPD denotes Relative Percent Difference

QA/QC FOR TOTAL ORGANIC CARBON

Results of the Matrix Spike Analysis

Sample B 18822 was chosen for matrix spike/matrix spike duplicate analyses. The percent recoveries, listed in Table 2.4, ranged from 66 to 94. The relative percent differences, also listed in Table 2.4, were 5 and 23.

Table 2.4 Results of the MS/MSD Analysis for Total Organic Carbon
WA # 3-710 National Lead

Sample ID B 18822

Sample Analysis (mg/kg)	MS Spike (mg/kg)	MS Observed (mg/kg)	Percent Recovery	MSD Spike (mg/kg)	MSD Observed (mg/kg)	Percent Recovery	RPD
2680	3556	5344	75	3556	6036	94	23
2680	4444	5746	69	4324	5526	66	5

Roy F. Weston, Inc.
REAC, Edison, N.J.
EPA Contract 68-03-3482

CHAIN OF CUSTODY RECORD

Project Name: NATIONAL LEAD
Project Number: 3347-033-001- 9710-01
RFW Contact: P. BOVITZ Phone: (908) 632-9200

SHEET NO. 1 OF 2

Note: TCLP metals Ag, As, Ba, Cd, Cr, Pb, Hg, Se, Ag.
Note: Total Metals Ag, As, Ba, Cd, Cr, Pb, Hg, Se, Ag, Ni by ICP or As, Se, Ni by furnace

SAMPLE IDENTIFICATION — **ANALYSES REQUESTED**

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/ Preservative	TCLP METALS	AA METALS
	A18814	E17	S	12/8/92	1	16 oz GLASS/4°C	X	X
	A18815	E12	S					
	A18816	E29	S					
	A18817	E16	S					
	A18818	W12*	S					
	A18819	W2	S					
	A18820	EE1A	S					
	A18821	P1	S					
	A18822	P2	S					
	A18823	P3	S	12/9/92				
	A18824	P4	S					
	A18825	P5 *	S					
	A18826	W18	S					
	A18827	W20	S					
	A18828	S4	SD					
	A18829	S2	SD					
	A18830	S13	SD					
	A18831	S11	SD					

NLI 002 0493

136008

00033

Matrix:
SD - Sediment
DS - Drum Solids
DL - Drum Liquids
X - Other
PW - Potable Water
GW - Groundwater
SW - Surface Water
SL - Sludge
S - Soil
W - Water
O - Oil
A - Air

Special Instructions: * MS/MSD FOR TCLP METALS AND AA METALS
- TAKE TCLP AND AA METALS FROM 8 OZ JAR.
- REFER TO CONTRACT DATED 12/4/92 ENCLOSED

FOR SUBCONTRACTING USE ONLY
FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
ALL/AA METALS		12/9/92		12-10-92	3:30p						

Roy F. Weston, Inc.
REAC, Edison, N.J.
EPA Contract 68-03-3482

CHAIN OF CUSTODY / LABORATORY REQUEST

No: 75

Project Name: NATIONAL LEAD
Project Number: 03347-033-001-4710-01
RFW Contact: C. BONITZ Phone: (908) 632-4200

SHEET NO. 2 OF 3

NLT 002 0494

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

	REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/ Preservative	GRAINSIZE	TOC	
37		C18814	E17	S	12/8/92	1	32oz GLASS/4°C	X	X	
38		C18815	E12							
39		C18816	E29							
40		C18817	E16							
41		C18818	W12							
42		C18819	W2							
43		C18820	EE1A							
44		C18821	P1							
45		C18822	P2							
19		B18814	E17				4oz GLASS/4°C		X	
20		B18815	E12							
21		B18816	E29							
22		B18817	E16							
23		B18818	W12							
24		B18819	W2							
25		B18820	EE1A							
26		B18821	P1							
27		B18822	P2							

00934 1369907 OM

Matrix:
SD - Sediment PW - Potable Water (S - Soil)
DS - Drum Solids GW - Groundwater W - Water
DL - Drum Liquids SW - Surface Water O - Oil
X - Other SL - Sludge A - Air

Special Instructions:

FOR SUBCONTRACTING USE ONLY
FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
Acc/Analysis		12/15/92		12.16.92	3:30p						

Roy F. Weston, Inc.
REAC, Edison, N.J.
EPA Contract 68-03-3482

CHAIN OF CUSTODY RECORD/LAB WORK REQUEST

NO. 7554

Project Name: NATIONAL LEAD
Project Number: 03347-033-001-4710-01
RFW Contact: P. Bevilla Phone: (908) 632-8200

SHEET NO. 3 OF 3

NLI 002 0495

SAMPLE IDENTIFICATION / ANALYSES REQUESTED

REAC #	Sample No.	Sampling Location	Matrix	Date Collected	# of Bottles	Container/ Preservative	GRAIN SIZE	TOC
	C18823	P3	S	12/9/92	1	32oz GLASS/4°C	X	
	C18824	P4	S					
	C18825	P5	S					
	C18826	W19	S					
	C18827	W20	S					
	C18828	S4	SD					
	C18829	S2	SD					
	C18830	S13	SD					
	C18831	S11	SD					
	B18823	P3	S			4oz GLASS/4°C		X
	B18824	P4	S					
	B18825	P5	S					
	B18826	W19	S					
	B18827	W20	S					
	B18828	S4	SD					
	B18829	S2	SD					
	B18830	S13	SD					
	B18831	S11	SD					

1360006

00035

Matrix:
(SD - Sediment) PW - Potable Water (S - Soil)
DS - Drum Solids GW - Groundwater W - Water
DL - Drum Liquids SW - Surface Water O - Oil
X - Other SL - Sludge A - Air

Special Instructions:

FOR SUBCONTRACTING USE ONLY
FROM CHAIN OF CUSTODY #

Items/Reason	Relinquished By	Date	Received By	Date	Time	Items/Reason	Relinquished By	Date	Received By	Date	Time
ALL ANALYSIS		12/10/92		12-16-92	3:30p						

ROY F. WESTON, INC./REAC
GSA RARITAN DEPOT
2890 WOODBRIDGE AVENUE
BLDG. 209 ANNEX
EDISON, NJ 08837-3679
908-632-9200 • FAX: 908-632-9205

ATEC Associates
5150 East 65th Street
Indianapolis,IN 46220-4871

December 14, 1992

Attn: John Dwenger
Project # 3347-33-01-4710, National Lead

As per Weston REAC Purchase Order number 08-83468, dated 12-14-92, please analyze samples according to the following parameters:

Analysis/Method	Matrix	# of samples
TCLP Metals/SW-846-1311 then analysis by SW-846-7000 Series	Soil	18
Metals,TCLP list prior to extraction/SW-846-7000 Series	Soil	18
Grain Size/ASTM D422 with hydrometer. See note below	Soil	18
Total Organic Carbon/SW-846-9060	Soil	18
Data package as per attached Deliverables Requirements		

Samples are expected to arrive at your laboratory on December 15,1992. All applicable QA/QC(MS/MSD) analysis will be performed on our sample matrix. A preliminary data package including a signed copy of our Chain of Custody is due at REAC on December 30, 1992, with the complete data package due by January 15, 1993. For the grain size analysis, both % organic and % moisture should be included in t.. analysis.

Should any questions or problems arise concerning this project, please call John Johnson at (908) 603-8023. For any billing questions, please call Cindy Snyder at (908) 632-9200. Thank you.

Sincerely,

Misty Barkley
Analytical Projects Control Group Leader
Roy F. Weston, Inc. / REAC Project

MB:jj Attachments

cc. R. Singhvi
M. Sprenger
Central File
4710Con.Atec
V. Kansal
Subcontracting File
T. Scrittorale
C. Snyder
P. Bovitz
Misty Barkley

NLI 002 0496

000?6

GSA RARITAN DEPOT
2890 WOODBRIDGE AVENUE
BLDG. 209 ANNEX
EDISON, NJ 08837-3679
908-632-9200 • FAX: 908-632-9205

MANAGERS DESIGNERS.CONSULTANTS

ATEC Environmental Consultants
5150 East 65th Street
Indianapolis, Indiana, 46220-4871
Attn: Mr. John D. Dwenger

January 21, 1993

Re: Project #3347-033-001-4710, National Lead
Ref.#: 0193-03, ATEC Work Order Number 9212215

We are reviewing the data for the analysis of As, Ba, Cd, Cr, Pb, Hg, Se and Ag. To complete our review of this data we need the specific details of how each spike was performed: including the spike volume and concentration used along with the sample volume used.

Could you please have faxed to me at (908) 603-8041 the needed corrections by 1/22/93 and hard copy to follow immediately. Please telephone **Chuck Shields at (908) 603-8042** if you have any questions.

Sincerely,

Misty Barkley
APC Group Leader
Roy F. Weston,Inc./REAC

CC: C. Shields
P. Bovitz Task Leader
Central File #3-710
M. Spenger Work Assignment Manager

Appendix B

APPENDIX B
U.S. EPA ERT/TAT XRF RESULTS
NL Industries Site
Final Report
February, 1993

SPECTRACE 9000 (S/N Q023)
LEAD X-RAY FLUORESCENCE DATA
NATIONAL LEAD SITE
PEDRICKSTOWN, NEW JERSEY
8-9 DECEMBER 1992
CONCENTRATIONS IN MG/KG (PPM)

SAMPLE ID	DATE	LEAD		STANDARD DEVIATION
NLE12	8 DEC	372		120
NLE16	8 DEC	710		307
NLE17	8 DEC	1225		524
NLE1	8 DEC	192	J	35
NLE27	8 DEC	885		700
NLE29	8 DEC	523		148
NLE2	8 DEC	596		169
NLEE1A	8 DEC	3217		1445
NLP1	8 DEC	414		76
NLP2	8 DEC	229	J	83
NLP3	9 DEC	7035		1101
NLP4	9 DEC	3780		1104
NLP5	9 DEC	9998		2273
NLP6	9 DEC	6268		666
NLS11	9 DEC	5669		229
NLS13	9 DEC	17934		755
NLS2	9 DEC	272	J	20
NLS4	9 DEC	912		23
NLS8	9 DEC	915		157
NLW12	8 DEC	1407		22
NLW13	8 DEC	913		24
NLW18	9 DEC	10475		74
NLW19	9 DEC	17193		61
NLW20	9 DEC	19183		232
NLW22	9 DEC	13875		141
NLW2	8 DEC	734		15
NLW3	8 DEC	792		43

DETECTION LIMIT - 96
QUANTITATION LIMIT - 321
J - DENOTES LEAD CONCENTRATION BETWEEN DETECTION AND QUANTITATION LIMITS

Draft Copy
Date 12/10/92

12-8-92
0630 Arrive office
0700 REAC
0730 leave REAC
0900 Arrive site
NL Industries

ECAL	Expected	Observed
Cd 109 Pb L_α	10.539	10.532
L_β	12.613	12.622
L_γ	14.762	14.761
Emission peak	22.16	22.110
Fe 55 K_α	2.307	2.3076
Emission pk	~~5.89~~ 5.89	5.8910
Am 241 Pb L_α	10.539	10.552
L_β	12.613	12.606
Emission pk	59.56	59.533

Recheck
Fe
Cd 109 source
Fe peak
max count 3619
1/2 max 1810

1759 - 6.2689 2 7016 6.5093
2193 - 6.7842 7445 - 6.5253

Measurement time
Cd 60 sec
Fe 30 sec
Mn 30 sec

Sample	Pb	
QATS B	21,636	
NLHE 28	530	
NLHW4	1643	
NLE17-1	681	Start sampling 1146
NLE17-2	1,062	
NLE17-3	1,933	
NLE12-1	541	
NLE12-2	272	
NLE12-3	303	
NLE2-1	381	
NLE2-2	795	
NLE2-3	612	
NLE16-1	839	
NLE16-2	286	
NLE16-3	1,005	
NLE29-1	399	
NLE29-2	731	
NLE29-3	439	
QATS B Rename (QATSA)	46,282	Run QATS Recalibrate
NLHE 28	532	
NLHW-4	1838	
QATS-B	20,931	
NLE1-1	219	
NLE1-2	143	
NLE1-3	214	

Sample	Pb
NLE27-1	1871
NLE27-2	460
NLE27-3	323
NLEE1-A-1	2024
NLEE1-A-2	2378
NLEE1-A-3	5250
Cup NLW2	755
NLW2-2	723
1140 NLW2-3	722
NLW3-1	731
NLW3 2	815
NLW3-3	829
NLW12-1	1397
NLW12-2	1437
NLW12-3	1382
NLW13-1	941
NLW123-2	552
NLW13-3	915
NLA1-1	343
NLA1-2	510
NLA1-3	375
NLA2-1	271
NLA2-2	302
1175-6 NLA2-3	1141
QATSB	22101
QATSB	21780
QATSB	22047
NLHE28	519
NLHG28	483
NLHE28	479
NLHW-4	1629
NLHW-4	1652
NLHW-4	1683

downloaded data
1900 - stripped wide - K Indelicato

12-9-92
NL Industries
0700 - met at hotel lobby
0810 - Arrived site - turned on XRF

Ecal		Expected	observed
Cd 109 Pb	Lα	10.539	10.536
	Lβ	12.613	12.611
	Lγ	14.767	14.767
Emission peak		22.16	22.10
Fe 55	S Kα	2.307	2.308
Emission peak		5.89	5.897
Am 241 Pb	Lα	0.539	10.518
	Lβ	12.613	12.611
Emission peak		59.50	59.51

Reschk
Fe
Cd109 Source
Fe peak
max Count 3473 1736.5 / 2)3473
1/2 max 1736.1

L 6.2526 keV R 6.5420
1588 1491
6.2687 keV 6.5259.
1843 1739

~~6.54 - 6.25 = 0.29 ok.~~ 0.54 / 0.25 / 0.29

Pre-Sorting Time

Li 60

Te 30

Sm 30

Sample	Pb	* - Sample collected
QPTS-5	21,571	
NLHE28	456	
NLHW-4	1,767	
NLP3-1	8,542	
NLP3-2	6,618	
NLP3-3	5,943	
NLP4-1 *	5,227	
NLP4-2	3,563	
NLP4-3	2,550	
NLP5-1 *	13,057	
NLP5-2	7,613	
NLP5-3	9,324	
NLP6-1	5,378	
NLP6-2	6,447	
NLP6-3	6,980	
NLW18-1 *	10,461	
NLW18-2	10,573	
NLW18-3	10,342	
NLW19-1	17,149	
NLW19-2	17,152	
NLW19-3	17,279	
QATS-B	20,874	
NLHE-28	555	
NLHW-4	2,274	
NLW20-1 *	19,029	
NLW20-2	19,511	
NLW20-3	19,011	

Sample		Pb
	3 samples collected	
NLW22-1		14,076
NLW22-2		13,778
NLW22-3		13,772
WP NLS2-1	*	300
NLS2-2		258
NLS2-3		259
NLS4-1	*	931
NLS4-2		880
NLS4-3	Written as NLS4-	926
GiTSB		21482
GiTSB		21251
GiTSB		21677
NLHE28		453
NLHE28		493
~~NLHE28~~		
WP NLS8.1		716
NLS8.2		930
NLS8.3		1100
NLS13.1	*	17,458
NLS13 2		17,319
NLS13 3		18,997
NLHE28		523
NLHW4		1995
NLHW4		2073
NLHW4		2151
WP NLS11-1		5510
NLS11.2		5505
NLS11.3		5993

~~HO~~
QATSB 21176
NLHEZS 476
NLHW11 1753

1700- left site
1900- arrived REAC - K Indelicato

12-11-92
0800- Arrived office
Holly Chem.
M. Hosler- can I go to Horseshoe Rd Solar next week w/ Reg 2 TMT

Appendix C

APPENDIX C
STATISTICAL OUTPUT
NL Industries Site
Final Report
February, 1993

FR-4710/pb

NATIONAL LEAD

Model: MODEL1
Dependent Variable: PB_AA

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	152535198.02	152535198.02	9.735	0.0066
Error	16	250697160.43	15668572.527		
C Total	17	403232358.44			

Root MSE	3958.35478	R-square	0.3783
Dep Mean	2872.55556	Adj R-sq	0.3394
C.V.	137.79907		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	553.258559	1192.9069118	0.464	0.6490
PB_XRF	1	0.496490	0.15912559	3.120	0.0066

NATIONAL LEAD

Obs	Dep Var PB_AA	Predict Value	Std Err Predict	Residual	Std Err Residual	Student Residual	-2-1-0 1 2	Cook's D
1	380.0	737.0	1157.136	-357.0	3785.447	-0.094		0.000
2	270.0	816.4	1142.260	-546.4	3789.962	-0.144		0.001
3	440.0	905.8	1125.979	-465.8	3794.831	-0.123		0.001
4	420.0	1161.5	1082.233	-741.5	3807.538	-0.195		0.002
5	380.0	2152.0	961.153	-1772.0	3839.890	-0.461		0.007
6	170.0	756.8	1153.382	-586.8	3786.592	-0.155		0.001
7	96.0	667.5	1170.451	-571.5	3781.351	-0.151		0.001
8	3600.0	4048.5	1006.248	-448.5	3828.320	-0.117		0.000
9	1000.0	2430.0	943.714	-1430.0	3844.213	-0.372		0.004
10	16000.0	5518.2	1260.731	10481.8	3752.217	2.794	*****	0.440
11	100.0	915.7	1124.200	-815.7	3795.359	-0.215		0.002
12	780.0	1248.3	1068.392	-468.3	3811.445	-0.123		0.001
13	15000.0	5756.5	1313.318	9243.5	3734.136	2.475	****	0.379
14	5100.0	10075.9	2490.087	-4975.9	3077.018	-1.617	***	0.856
15	140.0	687.3	1166.619	-547.3	3782.535	-0.145	.	0.001
16	730.0	1005.1	1108.476	-275.1	3799.981	-0.072		0.000
17	2200.0	3368.4	946.429	-1168.4	3843.546	-0.304		0.003
18	4900.0	9455.3	2306.874	-4555.3	3216.661	-1.416	**	0.516

Sum of Residuals	8.185452E-12
Sum of Squared Residuals	250697160.43
Predicted Resid SS (Press)	370669831.06

NATIONAL LEAD

UNIVARIATE PROCEDURE

Variable=DIFF_PB

Moments

N	18	Sum Wgts	18
Mean	1798.833	Sum	32379
Std Dev	4896.437	Variance	23975092
Skewness	1.419955	Kurtosis	2.807687
USS	4.6582E8	CSS	4.0758E8
CV	272.2007	Std Mean	1154.101
T:Mean=0	1.558644	Prob>|T|	0.1375
Sgn Rank	53.5	Prob>|S|	0.0182
Num ^= 0	18		

Quantiles(Def=5)

100% Max	14080	99%	14080
75% Q3	2840	95%	14080
50% Med	445	90%	13030
25% Q1	134	10%	-4520
0% Min	-6000	5%	-6000
		1%	-6000
Range	20080		
Q3-Q1	2706		
Mode	-6000		

Extremes

Lowest	Obs	Highest	Obs
-6000(	10)	2840(	5)
-4520(	13)	3440(	8)
-10(	1)	3470(	17)
130(	15)	13030(	18)
134(	7)	14080(	14)

NATIONAL LEAD

CORRELATION ANALYSIS

5 'VAR' Variables: AS BA CD CR PB

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
AS	17	34.259372	43.267801	582.409324	3.333333	138.888889
BA	18	42.447900	32.595966	764.062207	8.000000	110.126582
CD	8	14.685769	10.651385	117.486155	2.417582	29.113924
CR	18	20.327315	20.341924	365.891674	7.444444	92.682927
PB	18	4437.902577	6338.347551	79882	106.666667	18987

Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / Number of Observations

	AS	BA	CD	CR	PB
AS	1.00000	0.77567	0.39231	0.20000	0.63093
	0.0	0.0003	0.3364	0.4415	0.0066
	17	17	8	17	17
BA	0.77567	1.00000	0.40290	0.32392	0.66826
	0.0003	0.0	0.3223	0.1897	0.0024
	17	18	8	18	18
CD	0.39231	0.40290	1.00000	0.24034	0.74875
	0.3364	0.3223	0.0	0.5664	0.0326
	8	8	8	8	8
CR	0.20000	0.32392	0.24034	1.00000	0.16106
	0.4415	0.1897	0.5664	0.0	0.5232
	17	18	8	18	18
PB	0.63093	0.66826	0.74875	0.16106	1.00000
	0.0066	0.0024	0.0326	0.5232	0.0
	17	18	8	18	18

CORRELATION ANALYSIS

2 'VAR' Variables: PB PB_X

Simple Statistics

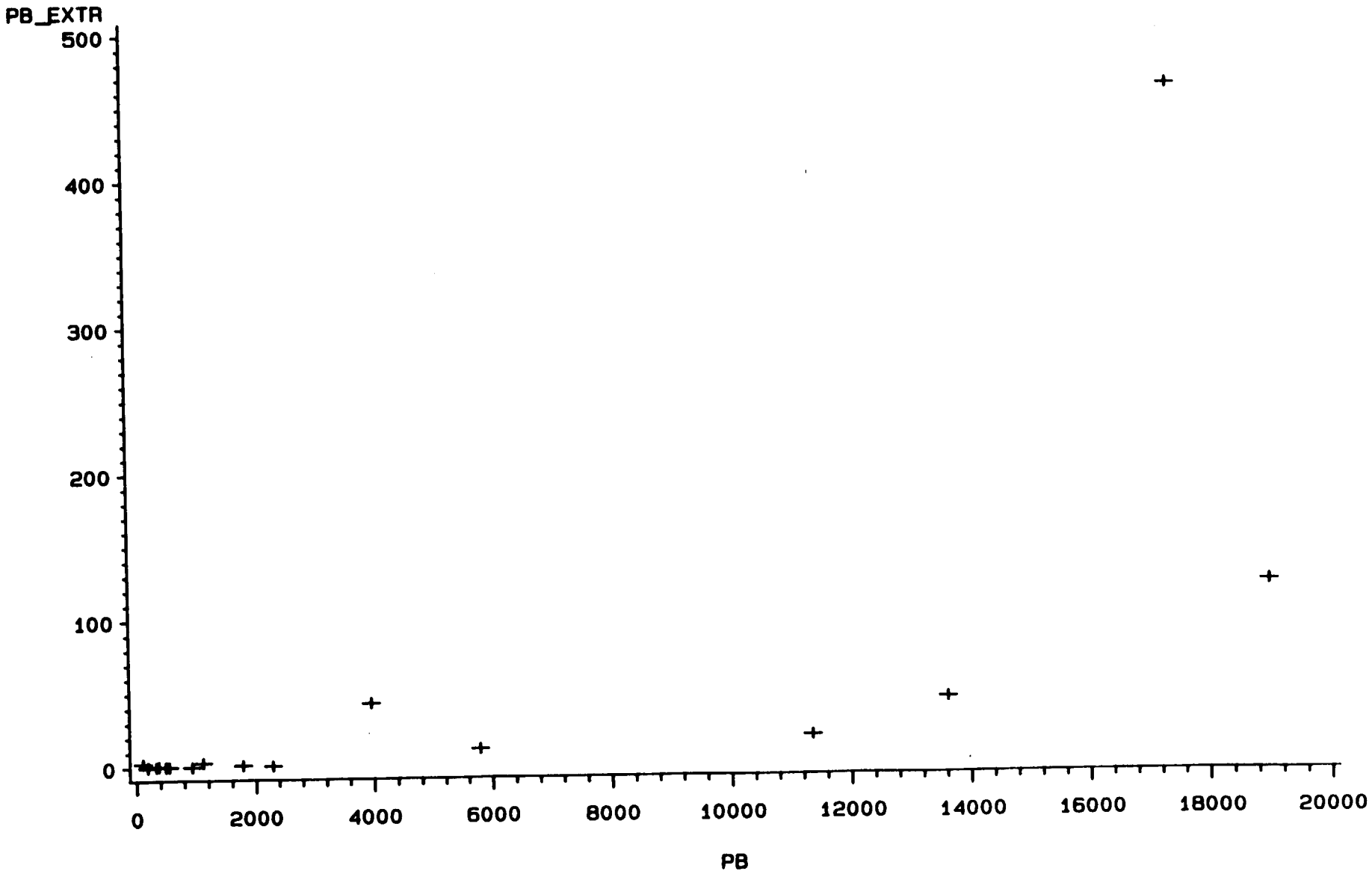
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
PB	18	2872.555556	4870.272117	51706	96.000000	16000
PB_X	18	39.327222	109.094793	707.890000	0.240000	460.000000

Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / N = 18

	PB	PB_X
PB	1.00000	0.84303
	0.0	0.0001
PB_X	0.84303	1.00000
	0.0001	0.0

wet weight

National Lead



NATIONAL LEAD
LINEAR MODEL

Model: MODEL1
Dependent Variable: PB_LEACH

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	97745.74349	97745.74349	14.954	0.0014
Error	16	104582.71347	6536.41959		
C Total	17	202328.45696			

Root MSE	80.84813	R-square	0.4831
Dep Mean	39.32722	Adj R-sq	0.4508
C.V.	205.57802		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-13.764423	23.48674257	-0.586	0.5660
PB_MG	1	0.119632	0.03093638	3.867	0.0014

NATIONAL LEAD
LINEAR MODEL

Obs	Dep Var PB_LEACH	Predict Value	Std Err Predict	Residual	Std Err Residual	Student Residual	-2-1-0 1 2	Cook's D
1	0.5500	-7.8532	22.627	8.4032	77.617	0.108	| | |	0.000
2	0.7200	-7.9362	22.639	8.6562	77.614	0.112	| | |	0.001
3	0.4200	-9.8728	22.913	10.2928	77.533	0.133	| | |	0.001
4	0.5700	-7.2659	22.546	7.8359	77.641	0.101	| | |	0.000
5	0.9000	13.6806	20.177	-12.7806	78.290	-0.163	| | |	0.001
6	0.2400	-11.5490	23.157	11.7890	77.461	0.152	| | |	0.001
7	0.4500	-2.6766	21.934	3.1266	77.816	0.040	| | |	0.000
8	0.4800	-11.4793	23.146	11.9593	77.464	0.154	| | |	0.001
9	2.9000	-12.4883	23.295	15.3883	77.419	0.199	| | |	0.002
10	43.0000	33.5626	19.114	9.4374	78.556	0.120	| | |	0.000
11	3.3000	-0.4719	21.658	3.7719	77.893	0.048	| | |	0.000
12	460.0	194.3	44.373	265.7	67.583	3.932	| |******	3.332
13	120.0	213.4	48.878	-93.3855	64.400	-1.450	| ** | |	0.606
14	18.0000	121.8	28.604	-103.8	75.619	-1.373	| ** | . |	0.135
15	1.4000	7.5360	20.754	-6.1360	78.139	-0.079	| | |	0.000
16	0.9600	-9.3569	22.839	10.3169	77.555	0.133	| | |	0.001
17	43.0000	149.1	34.183	-106.1	73.266	-1.448	| ** | |	0.228
18	11.0000	55.4964	19.509	-44.4964	78.459	-0.567	| * | |	0.010

Sum of Residuals	-1.49214E-13
Sum of Squared Residuals	104582.7135
Predicted Resid SS (Press)	200719.7266

NATIONAL LEAD
LOG LINEAR MODEL

Model: MODEL1
Dependent Variable: LOG_PB

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	46.20066	46.20066	83.579	0.0001
Error	16	8.84444	0.55278		
C Total	17	55.04510			

Root MSE	0.74349	R-square	0.8393
Dep Mean	1.76099	Adj R-sq	0.8293
C.V.	42.22002		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.606735	0.21598715	2.809	0.0126
PB_MG	1	0.002601	0.00028449	9.142	0.0001

NATIONAL LEAD
LOG LINEAR MODEL

Obs	Dep Var LOG_PB	Predict Value	Std Err Predict	Residual	Std Err Residual	Student Residual	-2-1-0 1 2	Cook's D
1	0.4383	0.7353	0.208	-0.2970	0.714	-0.416	| | |	0.007
2	0.5423	0.7334	0.208	-0.1911	0.714	-0.268	| | |	0.003
3	0.3507	0.6913	0.211	-0.3407	0.713	-0.478	| | |	0.010
4	0.4511	0.7480	0.207	-0.2969	0.714	-0.416	| | |	0.007
5	0.6419	1.2034	0.186	-0.5616	0.720	-0.780	| * | |	0.020
6	0.2151	0.6549	0.213	-0.4398	0.712	-0.617	| * | |	0.017
7	0.3716	0.8478	0.202	-0.4762	0.716	-0.665	| * | |	0.018
8	0.3920	0.6564	0.213	-0.2644	0.712	-0.371	| | |	0.006
9	1.3610	0.6345	0.214	0.7265	0.712	1.020	| |** |	0.047
10	3.7842	1.6357	0.176	2.1485	0.722	2.974	| |***** |	0.262
11	1.4586	0.8957	0.199	0.5629	0.716	0.786	| |* |	0.024
12	6.1334	5.1300	0.408	1.0034	0.621	1.614	| |*** |	0.562
13	4.7958	5.5452	0.449	-0.7494	0.592	-1.265	| ** | |	0.461
14	2.9444	3.5544	0.263	-0.6100	0.695	-0.877	| * | |	0.055
15	0.8755	1.0698	0.191	-0.1944	0.719	-0.270	| | |	0.003
16	0.6729	0.7026	0.210	-0.0296	0.713	-0.042	| | |	0.000
17	3.7842	4.1468	0.314	-0.3627	0.674	-0.538	| * | |	0.032
18	2.4849	2.1125	0.179	0.3724	0.722	0.516	| |* |	0.008

Sum of Residuals	1.110223E-15
Sum of Squared Residuals	8.8444
Predicted Resid SS (Press)	11.8360

NATIONAL LEAD

OBS	LOC	AS	BA	CD	CR	PB	PERC_PB
1	E17	6.353	8.000	.	8.8235	494.12	2.2262
2	E12	5.641	23.077	.	10.7692	487.18	2.9558
3	E29	6.024	10.843	.	9.3976	325.30	2.5822
4	E16	8.395	11.358	.	10.8642	543.21	2.0986
5	W12	55.882	76.471	.	21.4706	2294.12	0.7846
6	W2	12.963	59.259	.	8.8889	185.19	2.5920
7	EE1A	12.683	34.146	.	92.6829	926.83	0.9711
8	P1	6.067	25.843	.	10.6742	191.01	5.0259
9	P2	3.333	14.444	.	17.7778	106.67	54.3750
10	P3	20.879	29.670	2.4176	10.7692	3956.04	21.7389
11	P4	11.111	13.333	3.6667	7.4444	1111.11	5.9400
12	P5	15.217	32.609	21.7391	15.2174	17391.30	52.9000
13	W18	65.823	110.127	29.1139	32.9114	18987.34	12.6400
14	W20	124.444	104.444	10.2222	44.4444	11333.33	3.1765
15	S4	9.756	58.537	5.1220	18.5366	1780.49	1.5726
16	S2	.	26.316	.	13.1579	368.42	5.2114
17	S13	138.889	86.111	18.8889	19.1667	13611.11	6.3184
18	S11	78.947	39.474	26.3158	12.8947	5789.47	3.8000

National Lead

OBS	PERC_AS	PERC_BA	PERC_CD	PERC_CR	PERC_PB
1	.	.	.	.	2.2262
2	.	10.4000	.	.	2.9558
3	.	.	.	.	2.5822
4	.	.	.	.	2.0986
5	.	2.8769	.	.	0.7846
6	.	33.7500	.	.	2.5920
7	.	.	.	.	0.9711
8	.	10.8348	.	.	5.0259
9	.	31.8462	.	.	54.3750
10	.	4.6511	.	.	21.7389
11	.	14.2500	26.7273	.	5.9400
12	.	6.1333	26.6800	.	52.9000
13	.	5.9931	25.4174	5.83385	12.6400
14	.	5.1702	5.0870	.	3.1765
15	.	7.1750	.	.	1.5726
16	.	4.1800	.	.	5.2114
17	12.9600	15.7935	7.8353	.	6.3184
18	12.6667	8.1067	5.0160	.	3.8000